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6. AUTHORS
Arturo Ponce-Pedraza

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

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University of Texas at San Antonio
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San Antonio, TX 78249 -1644

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The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT
The Dual-Beam microscope (SEM/FIB) has been installed in the Kleberg Advanced Microscopy Center at UTSA. The SEM/FIB has opened new research opportunities and initiated new projects with other institutions and industry in the region. The model of the microscope is a "Zeiss Cross-Beam 340" which is a new desing manufactured in Germany. The new Zeiss CrossBeam 340 has novel capabilities for the preparation of samples for transmission electron microscopy (TEM), 3D reconstruction of milling of surfaces, and deposition of films with five injector sources (W,Pt,SiO,C,XeF2). The SEM/FIB is also equipped with an Omniprobe manipulator for the extraction of

15. SUBJECT TERMS
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Report Title

Final Report: Dual Beam System (SEM/FIB) Equipment for the Kleberg Advanced Microscopy Center

ABSTRACT

The Dual-Beam microscope (SEM/FIB) has been installed in the Kleberg Advanced Microscopy Center at UTSA. The SEM/FIB has opened new research opportunities and initiated new projects with other institutions and industry in the region. The model of the microscope is a "Zeiss Cross-Beam 340" which is a new desing manufactured in Germany. The new Zeiss CrossBeam 340 has novel capabilities for the preparation of samples for transmission electron microscopy (TEM), 3D reconstruction of milling of surfaces, and deposition of films with five injector sources (W,Pt,SiO,C,XeF2). The SEM/FIB is also equipped with an Omniprobe manipulator for the extraction of thin samples (lamellas) for TEM. In addition, the instrument has a detector for chemical analysis (EDS) and other detectors for imaging such as bright field, dark field, back scatter electrons and transmission. The new instrument has served for the research and education programs in Physics, Chemistry and Materials within UTSA and Alamo Community Colleges in the city of San Antonio. The microscope has also been used for teaching in the advanced microscopy course for undergraduate and graduate students. Finally with the new microscope has been used for research projects with publications in high impact scientific journals and also for presentations in conferences.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received		Paper
06/04/2015	9.00	Jesus Cantu-Valle, Francisco Ruiz-Zepeda, Fernando Mendoza-Santoyo, Miguel Jose-Yacaman, Arturo Ponce. Calibration for medium resolution off-axis electron holography using a flexible dual-lens imaging system in a JEOL ARM 200F microscope, Ultramicroscopy, (12 2014): 44. doi: 10.1016/j.ultramic.2014.06.003
06/04/2015	3.00	Francisco Ruiz-Zepeda, Yenny L. Casallas-Moreno, Jesus Cantu-Valle, Diego Alducin, Ulises Santiago, Miguel José-Yacaman, Máximo López-López, Arturo Ponce. Precession electron diffraction-assisted crystal phase mapping of metastable c-GaN films grown on (001) GaAs, Microscopy Research and Technique, (12 2014): 980. doi: 10.1002/jemt.22424
06/04/2015	4.00	D. Bruce Buchholz, Qing Ma, Diego Alducin, Arturo Ponce, Miguel Jose-Yacaman, Rabi Khanal, Julia E. Medvedeva, Robert P. H. Chang. The Structure and Properties of Amorphous Indium Oxide, Chemistry of Materials, (09 2014): 5401. doi: 10.1021/cm502689x
06/04/2015	5.00	Enrique Díaz Barriga-Castro, Víctor Vega, Javier García, Raquel Mendoza-Reséndez, Carlos Luna, Víctor Manuel Prida, Kornelius Nielsch, Fernando Mendoza-Santoyo, Miguel Jose-Yacaman, Jesus Cantu-Valle, Arturo Ponce. Quantitative magnetometry analysis and structural characterization of multisegmented cobalt–nickel nanowires, Journal of Magnetism and Magnetic Materials, (04 2015): 294. doi: 10.1016/j.jmmm.2014.12.022
06/04/2015	6.00	Gilberto Casillas, Ulises Santiago, Héctor Barrón, Diego Alducin, Arturo Ponce, Miguel José-Yacamán. Elasticity of MoS, The Journal of Physical Chemistry C, (01 2015): 710. doi: 10.1021/jp5093459
06/04/2015	7.00	J. E. Sanchez, F. Mendoza-Santoyo, J. Cantu-Valle, J. Velazquez-Salazar, M. José Yacaman, F. J. González, R. Diaz de Leon, A. Ponce. Electric radiation mapping of silver/zinc oxide nanoantennas by using electron holography, Journal of Applied Physics, (01 2015): 3430. doi: 10.1063/1.4906102
06/04/2015	10.00	Diego Alducin, Gilberto Casillas, Fernando Mendoza-Santoyo, Arturo Ponce, Miguel José-Yacamán. Kinematics of gold nanoparticles manipulation in situ transmission electron microscopy, Journal of Nanoparticle Research, (05 2015): 203. doi: 10.1007/s11051-015-2898-4
TOTAL:		**7**

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received	Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

1. VII International Conference on Surfaces Materials and Vacuum (VII ICSMV)
Title: In situ physical measurements in transmission electron microscopy
Authors: Arturo Ponce
Organizers: Sociedad de Superficies y Vacio
Place: Ensenada, Mexico Date: Oct. 2014

2. II International Workshop on Magnetic Nanowires and Nanotubes 2015
Title: Magnetic maps in metallic nanowires obtained by off-axis electron holography
Authors: Arturo Ponce
Organizers: University of Hamburg
Place: Meersburg, Germany Date: May 2015

Number of Presentations: 2.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received	Paper	
06/04/2015	15.00	John E. Sanchez, Francisco Ruiz Zepeda, Miguel Jose Yacaman, Arturo Ponce. Precession Electron Diffraction and Orientation Phase Mapping of Assembled Ag/ ZnO Nanoantennas, Microscopy & Microanalysis 2015 Meeting (accepted in April 2015). 02-AUG-15, . : ,
06/04/2015	13.00	Diego Alducin, Arturo Ponce , J. Eduardo Ortega . TEM In situ Plastic Deformation of Silver Nanowires, Microscopy & Microanalysis Meeting (accepted in April 2015). 02-AUG-15, . : ,
06/04/2015	14.00	Bethanie J.H. Stadler, Francisco Ruiz, Arturo Ponce, Fernando Mendoza-Santoyo, Mazin M. Maqableh, Israel Betancourt, Jesus Cantu, John E. Sanchez. Crystalline phase mapping associated to the magnetic flux in cobalt nanowires, Microscopy & Microanalysis 2015 Meeting (accepted in April 2015). 02-AUG-15, . : ,

TOTAL: **3**

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received	Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received	Paper	
06/04/2015	2.00	Jesus Cantu-Valle, Francisco Ruiz-Zepeda, Fernando Mendoza-Santoyo, Miguel Jose-Yacaman, Arturo Ponce. Calibration for medium resolution off-axis electron holography using a flexible dual-lens imaging system in a JEOL ARM 200F microscope, Ultramicroscopy (12 2014)
06/04/2015	16.00	Jesus Cantu-Valle, Israel Betancourt, John E. Sanchez, Francisco Ruiz-Zepeda, Mazin M. Maqableh, Fernando Mendoza-Santoyo, Bethanie J.H. Stadler, Arturo Ponce. Mapping the Magnetic and Crystal Structure in Cobalt Nanowires, Journal of Applied Physics (04 2015)
06/05/2015	17.00	John E. Sanchez, Ramón Díaz de León, Fernando Mendoza Santoyo, Gabriel González, Miguel José Yacaman, Arturo Ponce, Francisco Javier González . Resonance properties of Ag-ZnO nanostructuresat terahertz frequencies, Optics Express (05 2015)
TOTAL:	**3**	

Number of Manuscripts:

Books

Received	Book

TOTAL:

Received	Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

PhD Student of the PI has been awarded for the Microscopy and Microanalysis 2015 meeting. The award was notified on April 1, 2015. 2015 M&M Meeting/ Presidential Scholar award, for your paper entitled “On the weak forces on nanoparticles”.

Graduate Students

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Post Doctorates

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Faculty Supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME PERCENT_SUPPORTED

FTE Equivalent:

Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

Technology Transfer

DEPARTMENT OF THE ARMY
Final Report: Agreement Number W911NF-14-1-0096
Proposal No. 64756-MS-REP - Dual Beam System (SEM/FIB)
Equipment for the Kleberg Advanced Microscopy Center
PI: Dr. Arturo Ponce Pedraza

Table of Contents

List of Illustrations

List of Appendixes

I. Statement of the problem studied

The Dual-Beam microscope (SEM/FIB) has been installed in the Kleberg Advanced Microscopy Center at the University of Texas at San Antonio (UTSA). The SEM/FIB has opened new research opportunities and initiated new projects with other institutions and industry in the region. The model of the microscope is a "Zeiss Cross-Beam 340" which is a new desing manufactured in Germany. The new Zeiss CrossBeam 340 has novel capabilities for the preparation of samples for transmission electron microscopy (TEM), 3D reconstruction of milling of surfaces, and deposition of films with five injector sources (W, Pt, SiO, C, XeF2). The SEM/FIB is also equipped with an Omniprobe manipulator for the extraction of thin samples (lamellas) for TEM. In addition, the instrument has a detector for chemical analysis (EDS) and other detectors for imaging such as bright field, dark field, back scatter electrons and transmission. Another operation mode is the low vacuum which is used for non-conductive materials to avoid electrical charge on the surface of materials. Finally with the new microscope has been used for research projects with publications in high impact scientific journals and also for presentations in conferences. The microscope is a field emission gun (FEG) source with sub-nanometric resolution. In this way, the analysis of metallic nanoparticles has been also included. The projects achieved in the period of the project include the TEM sample preparation, the analysis of metallic nanostructures and the design of thin films prepare for devices using the manipulation of these nanostructures in substrates.

The project carried out has been part of new projects in transmission electron microscopy in which samples prepared with the FIB have been used as well as the nanostructures previously analyzed in the SEM/FIB have been studied by advanced TEM techniques such as nanobeam electron diffraction, electron holography, precession electron diffraction, in situ TEM experiments, and aberration-corrected microscopy in scanning transmission electron microscopy (STEM) mode. Nanostructures and thin films have been analyzed. Nanostructures include metallic nanoparticles, metallic nanowires, nanoantennas ZnO/Ag. The Thin films studied and prepared by using the FIB have been semiconductor compounds III-N/GaAs (001) by molecular beam epitaxy, metallic alloys for memory shape applications.

The new instrument has served for the research and education programs in Physics, Chemistry and Materials within UTSA and Alamo Community Colleges in the city of San Antonio. The microscope has also been used for teaching in the advanced microscopy course for undergraduate and graduate students. This project has been very important to UTSA in its effort to induce more Science, Technology, Engineering and Mathematics students in south Texas mainly with high impact to the Hispanic population. We have had one course about electron microscopy under the Nanotechnology program with Northwest Vista College (NVC) during the spring 2015. The aim of this program is to create nanotechnology-related technicians through the program’s innovative links with

high schools, four-year institutions, and Industry partnerships. The students at NVC can follow the bachelor degree and eventually one of our graduate programs at UTSA. Finally one PhD student has been graduated during the period of the project with a research project that involved the current project.

II. Summary of the most important results

The major goals of this research project have been the preparation of samples for TEM and the analysis of nanostructures such as metallic nanoparticles, metallic nanowires and hybrid semiconductor/metallic samples. The summary of the results obtained in the project are described below:

- The picture of the microscope Zeiss CrossBeam 340 is show in Figure 1.

Fig. 1. Dual-Beam microscope (SEM/FIB) Installed at UTSA.

- The whole sequence of the TEM sample preparation is illustrated below:

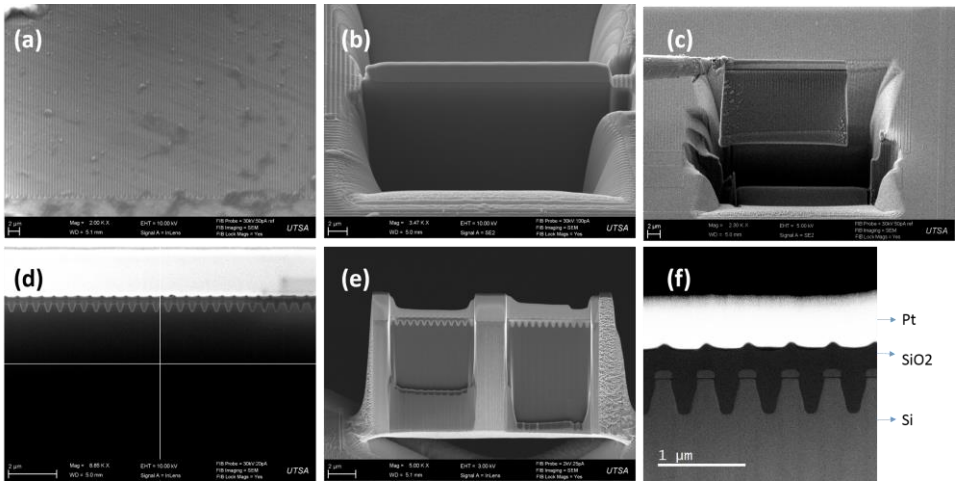


Fig. 2. Sequence of TEM sample preparation for a semiconductor transistor gate SiO2/Si: (a) surface, (b) removal of material and preparation of sample, (c) manipulation and extraction with omniprobe, (d) deposition in the grid, (e) final thinning, and (f) Final STEM image acquired in the JEOL ARM 200F microscope.

- Manipulation of metallic nanowires have been performed in TEM grids for their study in STEM and TEM. Figure 3 shows a set of images for the welding of a metallic nanowire and the deposition in a TEM grid.

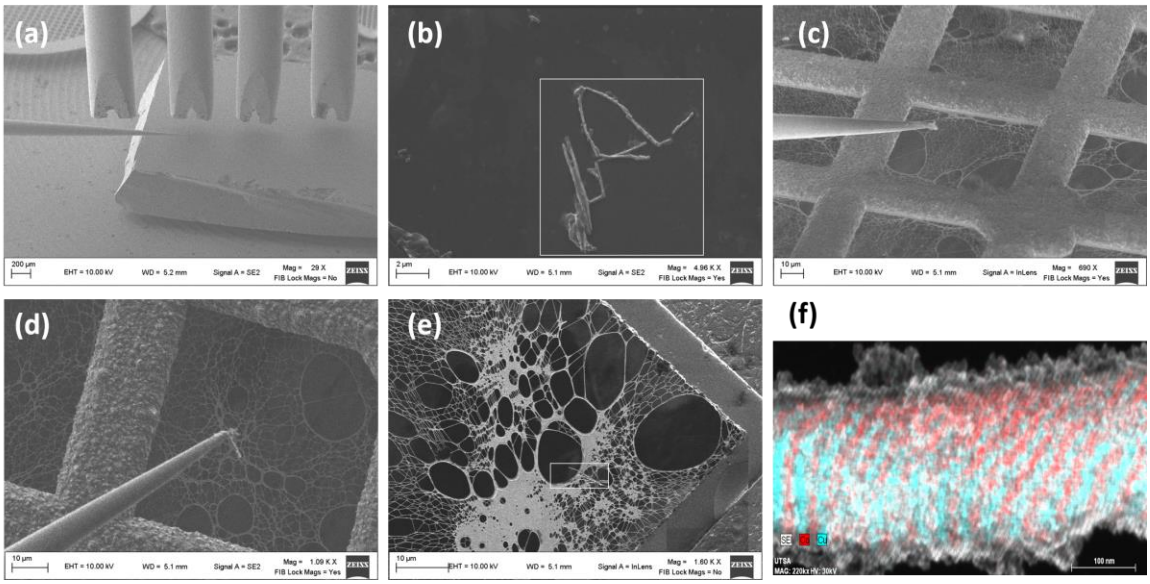


Fig. 3. Manipulation of metallic nanowires: (a) omniprobe inserted for manipulation, (b) metallic nanowires identified (c) manipulation of the nanowires to a TEM grid, (d) extraction of the nanowire, (e) cleaning process, (f) chemical mapping obtained in STEM mode.

- Analysis of polyhedral metallic nanoparticles with different detectors.

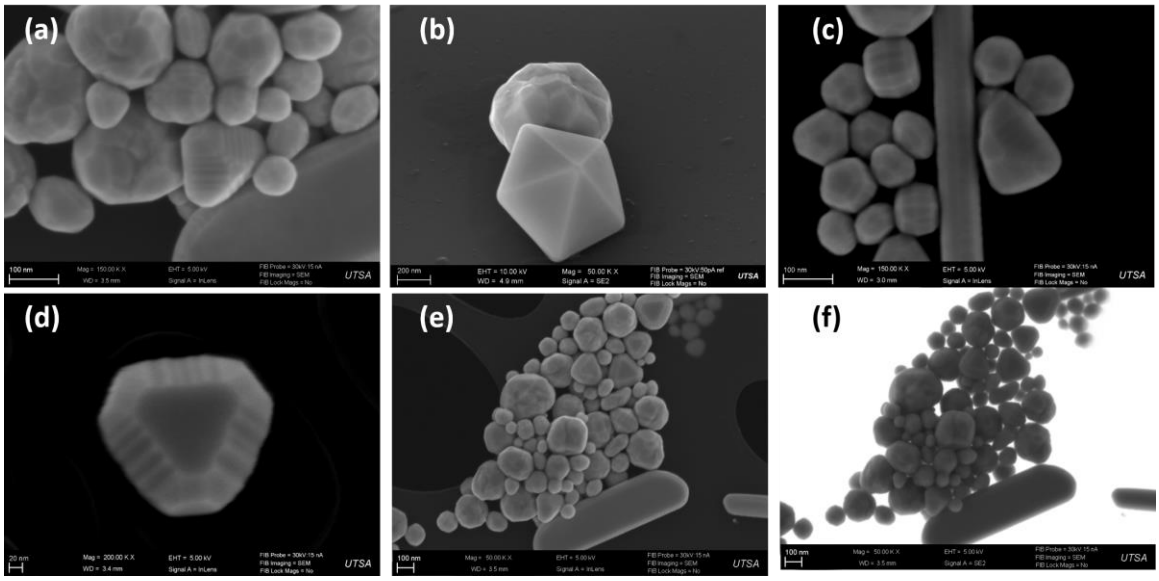
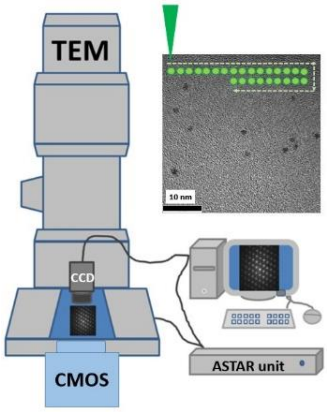


Fig. 4. Images from (a) to (f) correspond to a set of images using the SEM mode of the microscope.

- **Precession Electron diffraction (PED)** (Microsc. Res. Tech. 77 (2014) 980)

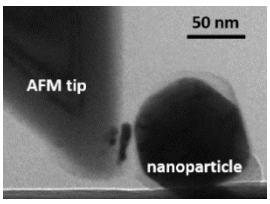
We have used samples prepared by the FIB for the analysis of their crystalline structure by using precession electron diffraction. Particularly we have studied the microstructure of the metastable cubic phase of GaN films grown by rf-plasma assisted molecular beam epitaxy (MBE) on (001) GaAs substrate using a recently developed transmission electron microscope (TEM) technique based on precession electron diffraction (PED). The control growth of the cubic meta-stable nitride phase is a challenge owing to the crystalline nature of the nitrides to grow in the hexagonal phase, and accurately identifying the phases and crystal orientations in local areas of the nitride semiconductor films is important for device applications. In this study we obtained phase and orientation maps of a metastable cubic GaN thin film using precession electron diffraction under scanning mode with a point-to-point 1 nm probe size beam. The phase maps revealed a cubic GaN thin film with hexagonal GaN inclusions of columnar shape. The orientation maps showed that the inclusions have nucleation sites at the cubic GaN {111} facets. Different growth orientations of the inclusions were observed due to the possibility of the hexagonal {0001} plane to grow on any different {111} cubic facet. However, the generation of the hexagonal GaN inclusions is not always due to a 60° rotation of a {111} plane. These findings show the advantage of using precession electron diffraction along with phase and orientation mapping, and the analysis can be extended to differently composed semiconductor thin films.



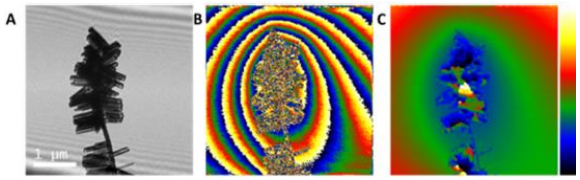
- **Electron holography** (Ultramicroscopy **147** (2014) 44, J. Magn. Magn. Mater. **379** (2015) 294, J. Appl. Phys. **117** (2015) 034306, Mapping the Magnetic and Crystal Structure in Cobalt Nanowires, *Submitted to* Journal of Applied Physics.)

We have started the calibration settings of electron holography and Lorentz microscopy in the JEOL ARM200F microscope. This project was the main topic in the thesis of the former PhD student Jesus Cantu-Valle, who graduated in December 2014 and it was part of current projects. Using electron holography we have opened new possibilities of collaboration in the study of magnetic materials using electron holography. These topics can be developed further when electron holography is combined with other operation modes such as cryoTEM, electron tomography, including in situ TEM and PED.

i) In situ TEM (J. Phys. Chem. C, **119** (2015) 710–715, J. Nanopart. Res. **17:203** (2015) 1, J. Appl. Phys. **117** (2015) 034306)



In Situ TEM is now one of the most important topics in electron microscopy beyond the atomic resolution. This is because to the possibility to measure properties or record the behavior of materials under external stimuli such as electrical signals, magnetic fields, mechanical forces or manipulation in real time. In this context, we have worked in the study of mechanical properties with in situ experiments two of the current PhD students have participated in mechanical deformation of MoS_2 sheets, manipulation of gold nanoparticles. We have studied the electric radiation in nanoantennas by using electron holography with modified TEM holders to induce electrical signals



III. Products

The project has been a key to prepare new proposals which have been successfully achieved in new infrastructure for the lab. One project associated to the Kleberg Advanced Microscopy Center is the NIH called Research Centers for Minority Institutions (RCMI), whchi has been granted during these three years. Our results obtained in the current proposal have been part of the justification for renewals of NIH grant. NIH has supported the KAMC as part of the Research Center for Minority Institutions (RCMI) program. The UTSA also received a grant from the NIH under the program RCMI for $12.3 Millions. The grant allocated $2.7 Millions (in five years) to support the establishment of a Core facility on nanotechnology applied to biological Problems.

Additionally, part of the products have been the publication in scientific journals, 3 technical presentations of scientific forums in which the PI has been invited. During the project we have published 7 per-review papers, 3 conference proceeding accepted (to be presented in August 2015), one PhD thesis, and 2 manuscripts submitted. All of this products have been attached in the ARO online system, in these scientific products we have referenced the acknowledgments as **Department of Defense # 64756-RTREP**. Here below the list of the scientific products:

a) PEER REVIEWED JOURNALS

1. J. Cantu-Valle, F. Ruiz-Zepeda, F. Mendoza-Santoyo, M. José-Yacaman and A. Ponce, "Calibration for medium resolution off-axis electron holography using a flexible dual-lens imaging system in a JEOL ARM 200F microscope" Ultramicroscopy **147** (2014) 44-50.
2. F. Ruiz-Zepeda, Y.L. Casallas-Moreno, J. Cantu-Valle, D. Alducin, U. Santiago, M. José-Yacaman, M. López-López and A. Ponce, “Precession

electron diffraction-assisted crystal phase mapping of metastable c-GaN films grown on (001) GaAs", Microsc. Res. Tech. **77** (2014) 980-985.

3. D.B. Buchholz, Q. Ma, D. Alducin, A. Ponce, M. Jose-Yacaman, R. Khanal, J.E. Medvedeva, R.P.H. Chang, "The Structure and Properties of Amorphous Indium Oxide", Chem. Mater. **26** (2014) 5401–5411.
4. J. Cantu-Valle, E. D. Barriga-Castro, V. Vega, J. García, R. Mendoza-Reséndez, C. Luna, V. M. Prida, K. Nielsch, F. Mendoza-Santoyo, M. José-Yacaman, A. Ponce, "Quantitative magnetometry analysis and structural characterization of multi-segmented cobalt-nickel nanowires" J. Magn. Magn. Mater. **379** (2015) 294–299.
5. G. Casillas, U. Santiago, H. Barron, D. Alducin, A. Ponce, M. José-Yacamán, "Elasticity of MoS_2 Sheets by Mechanical Deformation Observed by In-Situ Electron Microscopy" J. Phys. Chem. C, **119** (2015) 710–715.
6. J. E. Sanchez, F. Mendoza-Santoyo, J. Cantu-Valle, J. Velazquez-Salazar, M. José Yacaman, F. J. González, R. Diaz de Leon, A. Ponce, "Electric radiation mapping of silver/zinc oxide nanoantennas by using electron holography", J. Appl. Phys. **117** (2015) 034306.
7. D. Alducin, G. Casillas, F. Mendoza-Santoyo, A. Ponce, M. Jose-Yacaman, "Kinematics of gold nanoparticles manipulation in situ transmission electron microscopy" J. Nanopart. Res. **17:203** (2015) 1-7.

b) Articles recently submitted

1. J. Cantu-Valle, I. Betancourt, J.E. Sanchez, F. Ruiz-Zepeda, M.M. Maqableh, F. Mendoza-Santoyo, B.J.H. Stadler, A. Ponce, "Mapping the Magnetic and Crystal Structure in Cobalt Nanowires" April 2015 *Submitted to* Journal of Applied Physics.
2. J.E. Sanchez, R. Diaz de Leon, F. Mendoza Santoyo, G. Gonzalez, M. Jose Yacaman, A. Ponce, F.J. Gonzalez, "Resonance properties of Ag-ZnO nanostructures at terahertz frequencies", May 2015*Submitted to* Optic Express.

c) Invited talks

1. VII International Conference on Surfaces Materials and Vacuum (VII ICSMV)
Title: In situ physical measurements in transmission electron microscopy
Authors: Arturo Ponce
Organizers: Sociedad de Superficies y Vacio
Place: Ensenada, Mexico **Date:** Oct. 2014

2. Workshop on electron microscopy
Title: Beyond the atomic resolution in electron microscopy
Authors: Arturo Ponce
Organizers: Centro de Física Aplicada y Tecnología Avanzada

Place: Queretaro, Mexico **Date:** Dec. 2014

3. II International Workshop on Magnetic Nanowires and Nanotubes 2015
Title: Magnetic maps in metallic nanowires obtained by off-axis electron holography
Authors: Arturo Ponce
Organizers: University of Hamburg
Place: Meersburg, Germany **Date:** May 2015

d) Graduated theses

One PhD thesis was presented including acknowledgments to DoD No. 64756-RT-REP.: Jesus Cantu-Valle (2014). "Quantitative phase imaging of metallic nanostructures using off-axis electron holography" ProQuest Dissertations (ID 1650632736) ISBN: 1321473699.

III.1. Additional products

Teaching: The PI of the current proposal incorporated in his course "Advanced Electron Microscopy" the topic of TEM sample preparation using Focused Ion Beam. Which has been given the theory and practice to students during the spring 2015.

Workshop: During the frame of the project, we have organized a Workshop called **Advanced Electron Microscopy (AEM)**, which is the fourth edition. In this workshop we received students from UTSA and other institutions. We had 34 participants registered, 11 Invited speakers, 8 experimental sessions for practices in precession electron diffraction, electron holography, electron energy loss spectroscopy, and Focused Ion Beam with the microscope installed within the period of the project. The information about speakers and technical sessions are available at: https://sites.google.com/site/utsamicroscopy/events. In this web site a special recognition to the Department of Defense has been posted with the number of the proposal **No. 64756-RT-REP**.

IV. Budget Justification

As we requested, $500,000 dollars were used in the current project. The initial cost of the Zeiss dual beam was 1,332,668.00 USD + 75,000.00 USD for the manipulator of samples. However the company Zeiss made a discount of -675,456 dollars, resulting in a total price of 732,212.00 USD + 2,200 USD of shipping charges. Therefore the final price of the instrument was **734,412.00 USD**. In the proposal submitted the Department of Physics and Astronomy committed with an additional support through the STARTS package of Prof. Robert L. Whetten. This support was received as we described and **234,412.00 USD** were spent from Prof. RL. Whetten and the **500,000.00 USD** from the supported project. We have

considered other options in the market. In this way, the companies from which we received quotations were: FEI, JEOL, Tescan. None of them met the expectations and the offer made by Zeiss. As evidence of the budget in the report there are included the following attachments:

- **Appendix A:** Quotation from Zeiss
- **Appendix B:** Other Companies considered: JEOL, FEI, Tescan
- **Appendix C:** Sole Source from Zeiss
- **Appendix D:** Purchase Order from UTSA
- **Appendix E:** Installation Test

Appendix A
Quotation of the Dual Beam system: Zeiss
(9 pages)

QUOTATION

Quote Number: 545-34500167-3

Official Date: **March 31, 2014**

To: Dr. Arturo Ponce
Dept. of Physics & Astronomy
Univ. of Texas
1 UTSA Circle
AET 3.218
San Antonio TX 78249

Carl Zeiss Microscopy, LLC
One Zeiss Drive
Thornwood, NY 10594
(800) 233-2343
Fax (800) 488-6351
Corporation F.E.I.N. 13-1495820 D.U.N.S. 03-837-6674

Date: **March 31, 2014**

TEL: +1 210 4588267
FAX:

We propose to supply the instrumentation listed below at the prices quoted and under the conditions stated. Prices in this quotation are valid 30 days from above date. State and local taxes where applicable are not included. Freight charges will be prepaid and added to invoice. Buyer's acceptance is subject to our terms and conditions, which are either attached hereto, available at http://www.zeiss.com/microtandc or may be faxed upon request.

TERMS: Net 30 Days **FOB:** FOB Destination **EST. DELIVERY** 20 - 22 Weeks ARO

QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
		Zeiss Next Generation 340 Crossbeam Quotation ***State of Texas Contract 490-M2*** ***This Offer Is Only Valid on an Order Placed by April 30, 2014***		
1	3495999001055000	Basic Unit Crossbeam 340. FE-SEM with patented GEMINI electron optics for a wide range of analytic applications and in-situ experiments. The system can be operated in High vacuum or variable pressure mode. The FE-SEM is optimized for use with a Ga-focused Ion beam (Ga-FIB). Large chamber with 18 accesory ports, auto pendulum anti vibration system, 6-axes motorized super-eucentric stage, Chamber-SE and In-lens SE detector, Specimen current monitor, sample holder and 2 24" TFT monitors.	632,700.00	632,700.00
1	3495609001000000	Capella FIB column, fully integrated incl. electronic and Software. Ga-Liquid metal ion source (Ga-LMIS) with long source life time of 3000 µAh	376,200.00	376,200.00

QUOTATION

Quote Number: 545-34500167-3

Official Date: **March 31, 2014**

To: Dr. Arturo Ponce
Dept. of Physics & Astronomy
Univ. of Texas
1 UTSA Circle
AET 3.218
San Antonio TX 78249

Carl Zeiss Microscopy, LLC
One Zeiss Drive
Thornwood, NY 10594
(800) 233-2343
Fax (800) 488-6351
Corporation F.E.I.N. 13-1495820 D.U.N.S. 03-837-6674

Date: **March 31, 2014**

TEL: +1 210 4588267
FAX:

We propose to supply the instrumentation listed below at the prices quoted and under the conditions stated. Prices in this quotation are valid 30 days from above date. State and local taxes where applicable are not included. Freight charges will be prepaid and added to invoice. Buyer's acceptance is subject to our terms and conditions, which are either attached hereto, available at http://www.zeiss.com/microtandc or may be faxed upon request.

TERMS: Net 30 Days **FOB:** FOB Destination **EST. DELIVERY** 20 - 22 Weeks ARO

QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
		and high current stability. Resolution at 30 kV: 3nm. Voltage Range: 500V - 30 kV. Probe current range: 1 pA - 100 nA. Motorized high precision aperture changer, electrostatic beamblanker. Time interval between conditioning cycle of Ga Source: 72 hours.		
1	3495619500000000	Multi GIS for 5 different precursors including electronics and operating syst (for Crossbeam)	145,350.00	145,350.00
1	3495549001000000	AL80 P Carl Zeiss Airlock with 80 mm gate valve (No additional pumps are needed)	44,460.00	44,460.00
1	3482246102000000	Software License AUTOPREP. Workflow oriented Software for automatic preparation of multiple samples with different samples geometries, e.g. TEM lamellas	34,200.00	34,200.00
1	3495069005000000	4QBSD-Pneumatic-Smart P Pneumatic retractable 4 Quadrant	28,215.00	28,215.00

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QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
		solid state BSE-detector for all MERLINs. Requires mechanical port adapter.		
1	3495069015000000	aSTEM detector smart,assembly kit	33,345.00	33,345.00
1	3478058018100000	STEM on EBSD-Port, complete	1,368.00	1,368.00
1	4107901004000000	4 day advanced applications training class for FIB/SEM or Ion Microscopy at customer's site. Each class will be customized to customer's needs and include all training materials and handouts. Classes will be conducted by an Applications Specialist. Maximum of 6 participants per class (more possible for extra fee, determined on individual basis). Travel expenses are included in the price.	9,800.00	9,800.00
1	3482246105000000	Software License ORS Visual SI Visual SI 3D reconstruction and visualization software package, ideal for the post-processing of FIB/SEM tomography stacks. Includes annual maintenance for the first year from installation. PC not included.	6,075.00	6,075.00

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QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
1	3460239011140000	Control panel with rotary controls and keyboard. US English	5,775.00	5,775.00
1	4107133001000000	ThermoCube Air-cooled Liquid Chiller	4,250.00	4,250.00
1	3478239117100000	X-Ray/External Scan Input Panel Kit C/w	3,249.00	3,249.00
1	3495209031000000	20nA VP GI 20nA High resolution configuration for VP systems GEMINI I	2,565.00	2,565.00
1	3482246030000000	Compucentric Stage Software License	1,901.00	1,901.00
1	3482246062000000	Software Licence for Dual Channel Operation for MERLIN. (Requires second TFT monitor)	1,324.00	1,324.00
1	3482246003000000	Dual Magnification Software	1,275.00	1,275.00
1	3478058042000000	4Q BSD port adapter AURIGA and AURIGA 60	616.00	616.00
1	3478239056000000	Operating system Windows w/ keyboard		0
1	3465618077000000	Reservoir Pt		0
1	3465618071000000	Reservoir C14H10		0
1	3465618070000000	Reservoir W(CO)6		0
1	3465618075000000	Reservoir (CH3)2(C5H7O2)Au(III)		0
1	3465618080000000	Reservoir SiO2 (BDAC)		0

QUOTATION

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QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
		SubTotal		1,332,668.00
	0000001490890	1-Discount		-675,456.00
		Total		657,212.00
1	~3001760	Oxford/Omniprobe SDD EDX and AutoProbe 200	75,000.00	75,000.00
		This Offer Is Only Valid on an Order Placed by April 30, 2014		
		Total		75,000.00
		Shipping Charges		2,200.00
		GRAND TOTAL		734,412.00

QUOTATION

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TERMS: Net 30 Days **FOB:** FOB Destination **EST. DELIVERY** 20 - 22 Weeks ARO

QUANTITY	CATALOG NO.	DESCRIPTION	UNIT PRICE $	AMOUNT $
		STATE OF TEXAS CONTRACT #490-M2 Payment Terms Subject to State of Texas Contract 490-M2 Payment Terms Quotation prepared by: Germán Neal Carl Zeiss MicroImaging LLC german.neal@zeiss.com Cell Phone: 646-460-1605 Please reference this quotation by number when placing your order. You can email orders to: german.neal@zeiss.com Purchase orders must reflect the vendor stated as follows: Carl Zeiss MicroImaging, LLC One Zeiss Dr. Thornwood, NY 10594		

Standard Agreement for the Sale of Products

1. DEFINITIONS.
"Agreement": combination of these terms, and ZEISS's quote/invoice.
"Buyer": person (natural or legal) listed on the Front purchasing the Product(s), including heirs, executors, administrators, or successors.
"Components": accessories or non-System items sold under this Agreement.
"Front": parts of this Agreement specifying the Products, the Buyer, and specific payment, shipment or other unique terms.
"Parties": Buyer and ZEISS.
"Product(s)": System(s), Components, Software and related services stated on the Front.
"Software": software (in object code) incorporated with the Product(s) or as stated on the Front.
"System(s)": complete, functioning microscopes or imaging systems as stated on the Front.
"ZEISS": Carl Zeiss Microscopy, LLC.

2. ORDER OF PRECEDENCE. This Agreement is the sole expression of the understanding between the Parties regarding the Product(s), and supersedes any additional or differing terms in any Buyer's purchase order or other communication. ZEISS's acceptance of Buyer's purchase order is limited to these terms and is conditioned on Buyer's acceptance of these terms. Neither ZEISS's performance nor delivery of Product(s) will be construed as ZEISS's acceptance of Buyer's conflicting or additional terms or conditions. Terms on the Front supersede these general terms.

3. PRICE & PAYMENTS.
A. Prices (i) exclude any additional fittings or adjustments, and (ii) are net EXW (Incoterms® 2010) ZEISS's shipping point, exclusive of delivery and installation charges including, but not limited to rigging, or transit insurance. Buyer is responsible for all taxes, fees, levies, assessments, or other charge imposed by any local, state or federal government levied upon the production, sale, use, import, export, ownership or shipment of the Products, excepting taxes on ZEISS's net income.

B. Payment/Late Payment. Buyer will pay for the Product(s) within 30 days from shipment. No deductions or offsets are permitted. Amounts past due are subject to a service charge at the maximum rate of interest then-permitted by law until paid. Buyer will pay all of ZEISS's costs and expenses incurred in the collection of past due amounts, including reasonable collection agency or attorney's fees, court filing fees and other costs and disbursements.

4. RETURN POLICY. ZEISS will not accept any Product returns, unless it gives written consent in the form of a Return Authorization ("RMA"). Contact your ZEISS Customer Care Representative to obtain an RMA. A restocking fee of 20% will be charged for all Product returns. Buyer is responsible for the risk of loss, shipping and handling fees for returned Product. Unless ZEISS agrees otherwise, returned Product(s) must be in new condition and in the original packaging. Software, electronic parts (e.g. printed circuit boards) and consumable items (e.g.: bulbs, immersion oils, Ga sources, W filaments) are not returnable. No returns will be accepted after 90 days from acceptance (defined in section 9 of this Agreement).

5. CANCELLATION POLICY. If Buyer cancels this Agreement, ZEISS may charge Buyer a 20% cancellation fee. If Buyer and ZEISS agree to cancel part of this Agreement, ZEISS may adjust the price of the remaining Product(s) being purchased, and discounts offered on the original order may not be available on the adjusted pricing.

6. SHIPMENT, SHIPPING DATE.
A. Shipment. All shipments are made EXW (Incoterms® 2010) ZEISS's shipping points. Unless otherwise instructed by the Buyer, ZEISS will select the carrier. ZEISS may provide substitute Product(s) provided they are of equal or better performance criteria. At Buyer's request, ZEISS may provide partial shipments which may be invoiced accordingly.
B. Shipping Date. Shipping dates are estimated delivery dates, and not a material term of this Agreement. ZEISS will make all reasonable efforts to meet the delivery date. Unless otherwise agreed, ZEISS may ship Product(s) earlier than the date originally quoted.

7. TITLE, RISK OF LOSS, CLAIMS FOR DAMAGE IN TRANSIT.
A. Title. Title to the Product(s) passes to the Buyer upon ZEISS's delivery to the designated carrier.

B. Risk of Loss. ZEISS's responsibility ends on delivery of the Product(s) to the carrier, or such other point ZEISS designates. Buyer assumes all risk of loss for the Product(s) after ZEISS delivers the Product(s) to the carrier for shipment to Buyer, and Buyer's sole recourse for any loss of or damage to the Product(s) shall be against the carrier.

C. Claims for Damage in Transit. Buyer will carefully examine the Product(s) immediately upon delivery. Before signing any receipt, Buyer must note on the shipping receipt any visible damage to the Product(s) (or container) and notify ZEISS of that damage within five (5) days of receipt of delivery. Buyer's signature on a receipt without notation of damage or Buyer's failure to send notice to ZEISS of damage within such 5 day period will constitute proof of Buyer's receipt of the Product(s) in satisfactory condition.

8. FAILURE TO TAKE DELIVERY; DELAYED DELIVERY. If ZEISS is ready to ship, or has shipped, Product(s) to Buyer pursuant to this Agreement, and Buyer fails to take delivery or notifies ZEISS that delivery will be rejected, ZEISS may elect to treat such failure or notice as Buyer's repudiation of this Agreement and may recover from Buyer ZEISS's costs of manufacture, customization, preparation, shipping and storage of the Product(s). If Buyer requests a delay in delivery of more than 30 days, ZEISS may charge Buyer a holding charge of 2% of the net sales price per month.

9. ACCEPTANCE. Buyer's acceptance of the Product(s) will occur on the earlier of: (a) delivery to Buyer, if installation by ZEISS is not included in the purchase price; or (b) ZEISS's certification that the Products have been installed and meet ZEISS's specifications, if installation by ZEISS is included in the purchase price; or (c) Buyer's use of the Product(s). If Buyer uses third-party financing, the terms of that agreement must include a provision that incorporates the terms of this Agreement, and specifically including a provision that unequivocally obligates Buyer to provide the third-party financing entity with a certification of acceptance per this paragraph.

10. FORCE MAJEURE. ZEISS will make every reasonable effort to fulfill its obligations in a timely manner, but will not be liable for any loss or damage for delay in delivery, or any other failure to perform due to causes beyond its reasonable control including but not limited to**,** accident (in manufacture or otherwise) fire, storm, flood, earthquake, explosion, accident, acts of a public enemy, war, rebellion, insurrection, sabotage, epidemic, quarantine restrictions, labor disputes, labor or material shortages, embargo, failure or delays in transportation, unavailability of components or parts for machinery used for manufacture of its Product(s), "acts of God", acts of the Federal Government or any agency thereof, acts of any state or local government or any agency thereof, and judicial action. Buyer will also be relieved of liability for delays in acceptance or preparation of its facility due to such force majeure events. Should a delay occur, ZEISS may reasonably extend delivery or production schedules or, at its option, cancel the order in whole or part without any liability other than to return any unearned deposit or prepayment. ZEISS may also make partial shipments to Buyer and invoice accordingly, and Buyer shall be obligated to pay for such partial shipments when invoiced.

11. FINANCIAL INSTABILITY & SECURITY INTEREST. Buyer warrants that it has established a budget, and has approved financing to purchase the Product(s). Buyer warrants that it is able to: (i) pay its debts as they become due, (ii) presently pays its debts in the ordinary course of business, and (iii) is not insolvent within the meaning of the Federal Bankruptcy Act. Buyer understands that ZEISS relies upon these representations in extending credit under this Agreement. ZEISS may, at any time(s), suspend shipment or cancel its obligations hereunder, require: cash payments, payment in advance, satisfactory security for future deliveries, or other adequate assurances of performance, reasonably satisfactory to ZEISS, when in ZEISS's reasonable opinion, such measures are warranted because of Buyer's financial condition or other grounds for insecurity regarding Buyer's ability to perform under this Agreement. Until the Product(s) are paid for in full, Buyer gives ZEISS a security interest in: the Product(s), all monies received for the Product(s), or in chattel paper for the Products (e.g.: a lease).

12. LIMITED WARRANTY. Duration of Warranty: System(s) are warranted for **1** year (i.e.: 365 days) from shipment or from installation if installed by ZEISS (or its ZEISS authorized representative. **Labor** is warranted for **30** days from the completion of work. **Component(s)** which are produced by ZEISS are warranted for 1 year from the date of shipment or installation if installed by ZEISS (or its authorized representative). These timeframes are referred to, as applicable, as the "Warranty Period". **What Is Covered:** All System(s) and Component(s) will be free from defects in material and workmanship and all Labor will be performed in a professional ("workman-like") manner during the Warranty Period. **What ZEISS Will Do:** ZEISS will, at its option, repair or replace any items it determines to have failed due to defects in design, material or construction during the Warranty Period. If it is not possible to repair or replace such items, then ZEISS will refund the prorated value of the item. Although it may provide support for a longer period, unless noted otherwise, ZEISS warrants the availability of service for System(s) for 7 years from the date of sale; Components, which includes PCs and cameras, will have available support for three years.

What is Not Covered: This Warranty does not cover high-wear, consumable items (e.g.: light bulbs, cover slips, Ga sources). All third-party supplied Components (including consumables, software or hardware) will be covered by their manufacturer's warranty and arrangements for service or replacement must be made through that manufacturer. This Warranty does not cover failure that has resulted from: third party services, improper use or maintenance, accident, or environmental conditions outside of those prescribed in the Product specifications or industry standards, improper packaging or shipment, electrical failure, or unauthorized tampering, alteration or modification (except if any of the foregoing are performed by ZEISS).

Computers/Software: ZEISS does not warrant that the Product(s), Components or Software will be compatible or function as intended with Buyer's, or any third party, systems, computers, networks or software not purchased through ZEISS. During the Warranty Period, ZEISS will support Systems configured with non-ZEISS supplied computers, systems, networks or software, with up to 1 hour of Online Support. ZEISS is not responsible for virus, malware or other similar system problems arising from Buyer's connection to the internet or from Buyer's internal networks. Software is not warranted to be error free or to operate without problems or interruptions. If a defect or bug is identified, ZEISS will use commercially reasonable efforts to produce a repair (e.g.: patch/fix), which may also include minor enhancements, provided at no charge, that improve the performance of the Software, or keep it current with operating systems and other software. ZEISS does not assure compatibility with updates to third party software or operating systems and will not be responsible for problems arising from such updates.

Exclusive Warranty & Limitation of Liability: THE PROVISIONS OF THIS LIMITED WARRANTY ARE IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESSED OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. Exclusive Remedy: ZEISS's obligation to repair, replace or refund is the only remedy available for any claim arising from this Warranty, Agreement or the Products. **ZEISS WILL NOT BE LIABLE UNDER ANY THEORY OF LAW (e.g.: CONTRACT OR TORT) TO BUYER OR ANY OTHER PERSON FOR ANY PUNITIVE, SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES WITH RESPECT TO ZEISS'S OBLIGATIONS HEREUNDER, SUCH AS, BUT NOT LIMITED TO, DAMAGE TO, LOSS OF, OR LOSS OF THE USE OF OTHER PROPERTY OR EQUIPMENT, LOSS OF PROFITS OR REVENUES OR CLAIMS OF BUYER OR BUYER'S CUSTOMERS, FOR LOSSES OF ANY KIND.** Some jurisdictions do not allow limitations on exclusion of or limitation of remedies so the foregoing limitations and exclusions may not apply.

13. LICENSE FOR USE OF SOFTWARE. ZEISS grants Customer a non-exclusive, non-transferable license to use the Software, solely for Customer's internal uses. This license does not include the right to make copies of Software, extract, modify or incorporate any part of the Software, nor reverse engineer, decompile, or disassemble the Software. ZEISS does not have an obligation to supply software upgrades (i.e., new versions, or new, or in-line releases).

14. PATENT INDEMNITY. ZEISS will defend or settle any claim, suit or proceeding brought against Buyer based on allegations that the Product(s) infringe on a third party patent, provided that: ZEISS is notified timely of such claim, suit or proceeding; Buyer renders all reasonable cooperation to ZEISS; Buyer gives ZEISS the sole authority to defend or settle the same. If the Product(s) are held to infringe on any patent and the use of the Product(s) is enjoined, ZEISS will have the option, at its discretion (i) to procure Buyer the right to use the Product(s) or (ii) to modify the Product(s) so that they no longer infringe or (iii) refund Buyer the depreciated value of the Product(s) and accept the return thereof. This indemnity will not apply to changes made by ZEISS at Buyer's instruction or by Buyer, or by the use of third party items in conjunction with the Product(s) (unless sold or directed by ZEISS). ZEISS's total liability to Buyer will not exceed the depreciated value of the Product(s).

15. NOTICES. All notices, consents, requests, instructions, approvals and other communications hereunder shall be in writing and given by personal delivery, or by certified mail, return receipt requested, or by express delivery service to the address of Buyer or ZEISS as shown on the Front or to such other address as any party hereto may, from time to time, designate in writing. Notices shall be deemed to be effective on the date personally delivered, or five (5) days after deposited in the United States mail as certified mail, or one day after deposited with an express delivery service, as the case may be.

16. APPLICABLE LAW, DISPUTES, JURISDICTION AND VENUE. This Agreement is governed by and construed under New York State laws applicable to contracts made and to be performed wholly within New York State. The Parties will negotiate in good faith to resolve any dispute arising between them, and those negotiations will be considered as settlement discussions and not subject to discovery. The Parties will submit to the personal jurisdiction of the courts of competent jurisdiction in either Westchester or New York County, New York (at ZEISS's discretion), and to have their disputes resolved by a trial without a jury.

17. ENTIRE AGREEMENT. This Agreement is the entire statement of the understanding between the Parties, and the Parties enter into this Agreement solely on the terms of this Agreement without relying on any other expressions, verbal or written. This Agreement can only be modified in a writing signed by both the Parties.

18. NO WAIVER. The failure or delay to enforce any part of this Agreement will not constitute a waiver of the right to enforce such term or condition in the future.

19. SEVERABILITY. If a court of competent jurisdiction deems any of the provisions in this Agreement to be invalid, illegal or unenforceable ("Invalid") in any respect, the remainder of the Agreement will remain valid and the Parties will work in good faith to amend such Invalid provision in a manner that lawfully accomplishes the original intent of the Invalid provision. If removing or amending the Invalid provision has a material adverse effect on either party, then either party may terminate this Agreement without further obligation or liability.

20. ASSIGNMENT. Neither ZEISS nor Buyer may assign or transfer their rights or obligations under this Agreement, except that ZEISS may assign to its parent, subsidiaries or affiliates.

21. EXPORT / RE-EXPORT. The Product(s) may be subject to United States Export Administration Regulations and diversion contrary to U.S. law is prohibited. All transactions are conditioned on compliance with all applicable export control laws and regulations and all other applicable laws and treaties, including without limitation the Foreign Corrupt Practices Act, of the U.S.A., international treaty and/or the Buyer's country. Buyer agrees that it shall not, except as permitted by those laws, regulations or treaties, make any disposition, either by transshipment, re-export, diversion or otherwise, of Products in whole or in part. Buyer warrants that it will not export or re-export any Products with knowledge that they will be used in the design, development, production, or use of chemical, biological, nuclear, ballistic weapons or missile defense technology, or in a facility engaged in such activities, unless Buyer has obtained all required permits and approvals. Buyer further warrants that it will not export or re-export, directly or indirectly, any Products to embargoed countries or sell Products to companies or individuals listed on the Denied Persons List published by the Department of Commerce. All obligations in this paragraph survive any termination of this Agreement.

Appendix B
Other Companies considered: JEOL, FEI, Tescan - Quotations (25 pages)

JEOL USA, Inc.

11 Dearborn Road ● P.O. Box 6043 ● Peabody, MA 01961-6043 ● Phone: (978) 535-5900 ● Fax: (978) 536-2264 ● http://www.jeol.com

Quotation

Dr. Arturo Ponce-Pedraza
Dir., Kleberg Advanced Microscopy Center
University of Texas at San Antonio
Department of Physics & Astronomy
One UTSA Circle
Office: AET 3.218
San Antonio, TX

Quotation No.: 27236-1

Quotation Date: July 01, 2011

Price Valid 30 Days

Item	Your Inquiry No.:	Bid Date	
	Qty.	Description	Price
		Accessories for use with Model JEM-ARM200F, Acct. #11793, S/N 171000-01	
1	1	XEI-EVACTRON-25 EVACTRON 25 DE-CONTAMINATOR **RF Downstream Plasma Cleaner includes**: Plasma Radical Source (PRS) with MicroPirani Gauge, Electrically adjusted metering valve, RF Impedance Matching Network and Shroud. It also includes Table Top Controller/RF Generator with Automatic Pressure/RF Level Control and RS232 Interface. The RF Generator is stabilized and harmonically suppressed. Cable Bundle, Instructions, Null Modem Cable, and CD with GUI and Communications Library are also included. Designed for E-beam tools such as SEM, FIB, TEM and other analytic instruments where hydrocarbon contamination reduces resolution measurements and imaging, the microprocessor based Evactron Model 25 monitors operation, has internal memory and is factory programmed to allow minimum operator training. The Table Top Evactron 25 Controller uses a microprocessor with embedded software to regulate a leak valve and control the chamber pressure by a MicroPirani gauge. The microprocessor also regulates the RF power, and has a clock to time the downstream plasma cleaning and nitrogen purging cycles. The microprocessor also records the operational and fault log. The Evactron Model 25 operates from either the front panel or a remote computer. The Encoder Knob sets parameters in menus shown on the front panel display, and the Enable/Disable Button readies the Evactron Model 25 for downstream plasma cleaning. The RS232 interface communicates operating parameters, forward and reflected RF power, vacuum level read outs, and operation/fault log between the Evactron Model 25 and a remote computer through either the provided Graphical User Interface (GUI) or the C Communications Library. The tool pumping system controls the target vacuum start of the Evactron process. Raising the chamber pressure to > 2 Torr [270 Pa] and restarting evacuation begins the cleaning cycle if cleaning has been enabled by the Enable/Disable button or the computer. This insures that the vacuum system interlocks are not bypassed by the Evactron process. This interlock may be overridden by a factory installed jumper.	$20,000.00

DF = Duty Free DP = Duty Paid ND = No Duty DIA = Duty If Applicable

Item	Qty.	Description	Price

Downstream plasma cleaning power, pressure level, and cleaning time can be set from the front panel or the remote computer. Post plasma cleaning nitrogen purge can also be used. The nitrogen purge aids in the cleaning process and can reduce pump down times. Multiple plasma cleaning/purge cycles are also available. Pressure units used by the Evactron Model 25 may be changed between Torr, Pascal, and mBar. Non-corrosive gases other than room air can be used.

Specifications
Electronic Chassis: H, W, D - 5.5" x 9" x 7", 14cm x 23cm x 19cm
RF Power: 0-20 Watts at 13.56 MHz
LEDs: Power on, Enable, RF On, Plasma On, and Fault
Front Panel Display
Encoder Knob and Enable/Disable button for Front Panel Control
Power switch
Computer control with RS 232 I/O, DB9 Connector, Null Model Cable, 56k Baud.
GUI with Event Log
C Communication Library for software integration
Fixed RF Match mounted on RF feed through
KF 40 vacuum mounting flange
MKS MicroPirani Transducer for vacuum pressure measurement
Electrically adjusted metering valve for flow/pressure adjustment
RF power interlock prevents starting when out of vacuum pressure range
Fault display and readout
Nitrogen purge feature
100-240VAC 50/60 Hz input,
Shipping-16 lb. (8 kg)
Five year limited warranty
CE, NRTL and SEMI S2 Marks, RoHS compliant
(JU2010084)

2	1	XEI-7600F-FLANGE ADAPTER FLANGE FOR JSM-7600F	$600.00

Net Grand Total: $20,600.00

FOB: U.S. Shipping Points - Prepay and Add

Delivery: 30 days after receipt of order

Prices quoted do not include any applicable sales and/or use taxes.

Installation of the JEOL accessories quoted is included in the prices offered based on the fact that the instrument is under service contract or warranty. Should the contract be cancelled, or if the contract or warranty has expired, when installation is scheduled, on demand service rates and applicable engineer travel expenses will be charged.

Warranty of new components is 12 months from the date of their installation.

Payment Terms: Net 30 days after delivery

Item	Qty.	Description	Price

Kendis A. Nicolo
Sales Support Coordinator

cc: Z. Marek, District Sales Manager

QUOTATION for FEI Scios™

Ultra high-resolution analytical Dual Beam™ system

University of Texas San Antonio

Quote Date : February 14, 2014
Quote Number : QUO-49397-BQ4Q R0
Expires : April 30, 2014

Prepared By: **Dean Krogman**
Phone: +1 608.358.2455
Dean.Krogman@fei.com

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FEI Company • 5350 NE Dawson Creek Drive • Hillsboro, Oregon 97124
Tel: 503-726-7500 • Fax: 503-726-2570

FEI is a Total Solution Provider

FEI's philosophy is to offer the total solution to you as a customer. That means we don't only build and install the tools for you, but also have a wide array of solutions for all life cycle phases of the instruments. Training, Application Specialists, Remote tool services, Upgrade portal, trade-in program are just a few examples of what FEI can offer. Below is an overview of the most important services that make FEI a true total solution provider:

FEI Service

FEI Service, including RAPID and Environmental Consulting

FEI's Service organization is ready to assist our valued customers derive optimum performance and value from their tool investment. FEI's Customer Service Operations Centers are available 24/7 in over 50 countries worldwide, each with a knowledgeable support staff on hand to facilitate our customer's requests

FEI NanoPorts

FEI NanoPorts

FEI's four NanoPorts, located in China, Japan, the Netherlands, and the United States, are open doors to our customers and prospective customers. FEI's NanoPorts are a welcoming and private environment providing invited customers and guests with a valuable, interactive experience that showcases FEI's electron microscopy solutions and their capabilities

FEI Owners

FEI.Com for Owners

FEI.com for Owners is an exclusive online portal of tools and resources for FEI's instrument owners and users. It offers various services such as:

- Exclusive offerings for instrument owner, including upgrades, parts, RAPID
- Training by FEI Academy - class schedules, registration & more
- Owner forums and Online User Clubs

FEI Academy

FEI Academy

At FEI Academy our Application Engineers train hundreds of new and existing customers every year on the latest tools and techniques covering applications for all of our customers from areas such as in Materials Science, Natural and Life Sciences, and Semiconductor and Electronics

FEI Certified

FEI Certified

The FEI Certified Tools program features factory-refurbished FEI systems that are fully-tested and warranted to meet original factory specifications. With the Certified Tools program, customers will have greater flexibility and added confidence while they plan capital equipment acquisitions

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Proposed Solution

Line #	Part Number	Description	Quantity	
Scios				
1	1031104	**The core Scios instrument includes:** - Workstation with Windows 7 - 1 x 24'' widescreen LCD monitor - xT software version 7.x and new xT UI - NICol electron column - High-throughput ion column - 110 x 110 mm eucentric stage - Multi-purpose holder - CCD IR camera - In-lens detectors: Lower (T1) and Upper (T2) - SE detector (ET-SED) - Oil-free pumping system - Integrated current measurement - Automatic aperture system - Large table top with support	1	
Front Port				
2	1033506	FEI EasyLift EX NanoManipulator	1	
GIS Port 4				
3	FP 3400/31	Platinum Deposition (Pt)	1	
Automated Serial Sectioning and Imaging				
4	FP 3550/25	Auto Slice and View G3	1	
Beam Deceleration				
5	FP 6842/22	Beam Deceleration	1	
Detectors				
6	1046308	In-Column Detector (T3)	1	
7	1049668	Retractable STEM 3 Detector	1	
8	1041650	STEM 3+ Option	1	
9	1050488	Solid-state Detector Integration Kit	1	
Accessories				
10	1049665	Nav-Cam+	1	
11	FP 2311/05	Manual User Interface	1	

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12	1018263	Windows 7 Support PC	1	
13	9432 909 96411	Compressor 120 V, 60 Hz with 4-liter Tank	1	
Specimen Holder(s) and Accessories				
14	FP 2301/12	Dual TEM Grid Holder	1	
15	1043821	Load Base	1	
16	FP 2301/10	Specimen Holder Kit	1	
17	FP 3600/48	Universal Lift-out Holder	1	
Installation Kit				
18	9425 061 69515	NA Installation Kit Scios	1	
Training				
19	9425 060 99100	On-site Training/Support (1 day, offered by Hillsboro)	5	
Transport Options				
20	4022 400 43831	CIP Brno / Named place of destination in North America (T-3)	1	
		List Price Total	**$1,423,211.00**	

Pricing Summary (in USD)	
List Price	$1,423,211.00
Total Discount (51%)	- $729,000.00
Sub-total including discount	$694,211.00
Taxes	
VAT / Estimated Duty	
Grand Total	**$694,211.00**

Key Term Summary	
Billing Terms	30% / 60% / 10%
Payment Terms	NET 30
Payment Method	
INCOTERMS 2010	CIP
Indicative Delivery Period	
This proposal is valid until	April 30, 2014

Duty* and Taxes NOT included

*You may qualify for duty free entrance if an application is submitted to the Department of Commerce and US Customs. If you elect not to submit an application or your application is denied, duty is 3.5% of the purchase price.

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Solution Description

1031104 Scios

Scios is the most versatile high-resolution SEM/FIB for 2D and 3D material characterization and analysis. The instrument combines innovative electron and ion optics with state of the art patterning control. This combination expands the characterization and analytical capabilities of your laboratory, by providing better and faster ways for material characterization, analysis and sample preparation.

The key enabling technologies are all integrated onto a single platform and comprise:

- Novel Field Emission Electron Optics optimized for both high current and high resolution meeting all imaging and analysis needs
- Trinity detection system for fast imaging, and easy collection of all available signals
- High-resolution (field emission) Ion Optics with fast high-throughput milling capabilities
- Gas Chemistry technology for enhanced milling rates including FEI proprietary gasses such as Selective Carbon Mill
- High-precision specimen goniometer with 110 mm travel along the x and y axes
- A Windows 7, 4-quadrant “Beam per Quad” User Interface with User Guidance
- System architecture is optimized for automation, which is optionally available (e.g. *AutoSlice and View™G3*)

Features and specifications:

Geometry:

On a 21-port specimen chamber the electron and ion column are mounted at an angle of 52 degrees to each other. The beam coincidence point is at 7 mm working distance, which is also the eucentric working distance of the stage and the analytical working distance. There are four GIS ports grouped around the ion column.

Vacuum

Scios uses an entirely oil-free vacuum system, featuring:

- 1x 240 l/s turbomolecular drag pump
- 1x Scroll pumps
- 3x Ion Getter Pumps (2 for electron column, 1 for ion column)
- Integrated battery backup for IGPs on the electron column, a FEG safety mechanism (for recoverability after an unplanned power outage)
- Auto bake-out and Auto-start enable fast and easy maintenance of the FEG source

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Sample Navigation

Scios is standardly equipped with a 5-axes motorized x-y-z-tilt-rotate stage, providing movements:

- x = y = 110 mm (motorized); z = 65 mm (motorized)
- Tilt -15 to +90 degrees (motorized)
- Eucentric tilt
- A unique standard specimen holder with labeled positions and unique stage mounting, allowing simultaneous loading of 18 standard samples (∅ 12 mm), three 45˚ pre-tilted samples, three row bars (vertical, horizontal and 52˚ pre-tilted)

A selection of additional sample holder kits is optionally available (including stub holders, TEM sample holders and vise specimen holders).

Joystick stage control is available as an option.

Stage control software includes standard facilities for:

- Store and recall of sample position
- Double-click-to-center and drag-to-zoom feature select functions
- Multi-directional stage drive
- Compucentric rotation
- Compucentric tilt
- Image feature alignment to horizontal or vertical
- Navigation on image and navigation montage is supported with “Click-to-center” and “Drag-to-Zoom” functions
- External image import and registration for correlation.

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Electron Optics

Scios features a pre-aligned electron optical column, which is optimized for high resolution and for beam stability. The main elements of the electron optical system are:

Source: Field emission gun assembly with Schottky emitter source. The assembly is optimized for high brightness/high current, providing low-noise imaging. The pre-alignment of the FEG ensures no mechanical alignment is required. Easy gun installation and maintenance is provided with Auto bake-out and Auto Start capabilities.

Objective Lens: Dual Objective combining field-free magnetic and electrostatic lenses, with a 60 degree geometry

Voltage: 200 eV to 30 keV (20 eV landing energy possible with optional Beam Deceleration)

Beam Current: 1 pA *to* ≥200 nA

Resolution:

at Optimum working distance

- 0.8 nm at 30 kV (STEM)
- 1.0 nm at 15 kV (Trinity)
- 1.6 nm at 1 kV (Trinity)

at eucentric working distance

- 2.5 nm at 1 kV (Trinity)

Ion optics

Field emission focused ion beam optics with liquid Gallium ion emitter.

- Source lifetime: >1000 hours
- Voltage: 500 V to 30 kV
- Beam current: 1.5 pA - 65 nA in 15 steps
- Resolution: 5.0 nm @ optimum working distance

Scanning system

High-resolution digital scanning engine controlled from the User Interface.

- Pixel density 768 x 512, 1536 x 1024, 3072 x 2048, 6144 x 4096, selectable
- Minimum dwell time 25 ns/pixel; maximum 25 ms/pixel
- Electronic scan rotation by n x 360 degrees

Patterning (Milling) system

High-resolution digital patterning engine controlled from the User Interface

- Maximum resolution: 64k x 64k
- Minimum Dwell Time: 25 ns/pixel
- Maximum Dwell Time: 25 ms/pixel
- Multiple standard pattern shapes and recipes, including annular milling
- Variable dwell time pattern to give 3D milling
- Complex milling patterns through Bitmap import, dynamic threshold milling, array generation, exclusion zones and polygon building

Detection

Scios features a secondary electron detector (Everhart-Thornley SED), optimized for use across the available kV and current range. The Trinity detection system is comprised of a segmented, lower in-lens detector (T1), an upper in-lens detector (T2) and an optional in-column detector (T3). An integrated IR-CCD camera is standard for in-chamber viewing and an optional Nav-Cam™ color optical camera can be used to take top-down images of samples for navigation. Also optionally available are a retractable Directional Backscatter (DBS) detector, a secondary electron/secondary ion detector (ICE), and a STEM detector for imaging FIB-prepared cross sections with a transmitted beam.

Imaging

Images are displayed in an area of 1536 x 1024 pixels, configurable for either single-frame or four-quadrant display. Images can be viewed live, averaged or integrated. The Scios fully supports the FEI SmartSCAN™ advanced scanning strategies which allows line averaging and interlaced scanning in addition to Drift Corrected Frame Integration (DCFI). Still images can be saved in TIFF, BMP, JPEG file formats, and in 8-bit, 16-bit or 24-bit depth, to the hard disk or LAN from the graphical user interface. Image printing is also available from the user interface. In addition, the system supports recording of AVI movies. This can either be done on the fly or by capturing a series of TIFF images at user-specified intervals. These TIFF images can then be combined into AVI's by using the included proprietary FEI movie creator software.

The software includes a 4-quad mode, in which the quadrants can be used for live display of electron images (SE, BSE), mixing of signals and display of the image of the standard infrared (IR-CCD) camera.

Look-up tables allow image contrast, brightness or gamma to be enhanced. Flexible databar selection is also provided. User-definition of preferred imaging parameter sets is available. Imaging parameters are stored in the TIFF image file as private data. Finally, image measurements and annotations can be performed live on the image and the results can be stored together with the images.

Current measurement

A fully integrated Current Measurement option with sub-picoampere resolution and superior sensitivity, which makes it well suited for characterizing low current phenomena. With the electron beam/ion beam pointed at the Faraday cup, precise probe current measurements and current stability measurements can be performed.

This device measures currents ranging from 1 pA up to 2 µA with up to 10 readings per second. The current read-out is displayed in the user interface.

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Milling

Predefined mill patterns can be drawn in overlay in any of the four quadrants in the UI. Progress of the milling is monitored in the User Interface through a progress bar. End-point detection is available through an integrated real-time monitor. Simultaneous imaging and milling is a standard feature of Scios

System control

Scios is controlled from an MS-Windows 7 graphical user interface running at a 1920 x 1200 screen resolution. The PC workstation is based on an Intel Xeon W3520 Processor/ 2.66 GHz 8 MB cache, 12 GB system memory, one 500 GB hard drive, one 16x DVD+/-RW drive, integrated FireWire and USB ports and a 1 Gb LAN network card (computer specifications subject to change). The system includes a 24" LCD monitor, keyboard, optical mouse and a height-adjustable office desk. A USB manual user interface (for controlling magnification, contrast/brightness, beam shift and stigmators) and/or a Joystick (for control of stage movement) is optionally available.

The microscope controller is dedicated to its primary function, includes a DVD/RW and has a possibility to connect directly to a LAN. Optionally, a support computer can be connected for additional PC-based functionality such as MS-Office software suite, firewall, anti-virus and other non-instrument software.

RAPID

This instrument is RAPID-enabled. RAPID (Remote Access Program for Interactive Diagnostics) is a highly secure connectivity tool that enables FEI's service engineers to connect directly to the instrument to address system issues remotely. RAPID can significantly speed up repair time and thus reduce instrument downtimes, while improving FEI's overall quality of service. FEI's service engineers use RAPID to perform remote system diagnostics and repairs, support user operation and view images for enhancing system performance. However, customers maintain complete control of how and when RAPID is used -- each RAPID session must be initiated by the customer. RAPID requires a high-speed internet connection (> 5 MB/sec recommended, 1 MB/sec required). For full details please browse to the RAPID pages on www.fei.com.

System Support

The microscope entitles the owner to free access to the on-line resources of FEI for Owners and free membership of the FEI FIB & DualBeam User Club (see www.fei.com/owners for details). These are valuable resources enabling users to link to other users of FEI instruments around the world. Main features are:

- Learn and stay updated on new developments, microscope enhancements and applications
- Share expertise and knowledge with peers
- Discuss and communicate with FEI specialists
- Share automation scripts for the (optional) iFast automation software packages

By using these support activities, customers of FEI are able to interact with other users directly and share knowledge, which will help them being more successful.

Installation requirements

Please refer to Scios pre-installation guide.

1033506 EasyLift EX NanoManipulator

The EasyLift family of NanoManipulators is FEI's advanced and preferred solution for in-situ sample manipulation and TEM lamella transfer. All EasyLift models are integrated with the microscope xT software to provide an easy, intuitive method for sample manipulation inside the DualBeam chamber. With motorized needle rotation included, EasyLift EX provides superior performance for TEM sample preparation. EasyLift EX includes increased precision, increased stability, and motorized needle rotation for easy preparation of traditional, plan view, and ultra-thin TEM samples.

EasyLift EX Product Features:
- Software control integrated into the DualBeam user interface
- Stable, consistent, and repeatable movement in any direction
- Closed-loop encoder feedback enabling easy restore/recall of probe positions
- Motorized, 360º control of needle rotation
- Comes with a supply of 10 replacement needles and 50 pcs of halfmoon molybdenum grids.

EasyLift EX includes the following enhanced stability performance:
- Smallest step size <50 nm
- Omni-directional repeatability <100 nm
- True 'Z' movement of 500 nm over a 5 µm Z stroke
- Drift <50 nm / min

System Requirements:
The FEI EasyLift EX NanoManipulator can be used on the following instruments:
- Helios NanoLab 600i with commercial code 1033504
- Helios NanoLab 650 with commercial code 1033501
- Helios NanoLab 660
- Versa 3D DualBeam with software xT 6.3 or higher
- Scios with software version 7.x or higher

The FEI EasyLift EX NanoManipulator is standard included in the following instruments:
- Helios NanoLab 450F1 / 460F1
- Helios NanoLab 450HP / 460HP

FP 3400/31 Platinum Deposition
Gas chemistry solution for Ion or Electron beam deposition of Platinum-containing material. Platinum gas chemistry is the preferred metal deposition in case ease of use, high deposition rate and precision of the deposition is required. The package includes the gas precursor, injection needle, gas injector system and controller. This gas chemistry option is assembled, tested and shipped with the basic microscope or DualBeam.

Important note: the customer is responsible for making sure a fume hood is present for on-site service of this chemical by an FEI engineer

FP 3550/25 AutoSlice and View™ G3

AutoSlice and View G3 is the third generation of FEI's automation software for automated serial sectioning and imaging through a user-defined volume of a specimen. The sequence of images captured by AutoSlice and View G3 can be compiled into a video or can be used as input for 3-dimensional reconstruction of the sliced volume.

The new G3 version of AutoSlice and View include a number of key enhancements to improve automation success, increase reliability, provide feedback and facilitate setup and process monitoring/pausing and re-starting over previous G1 and G2 versions. Some notable key features include:

- Dedicated user interface that guides the user with a step-by-step process.
- Acquisition of multiple images with independent settings (resolution, dwell, FOV, detector, kV) for each slice
- Digital zoom for accurate cut placements
- User defined fiducial type and placement
- Use existing fiducials or sample features for re-aligning cuts and images
- Image recognition of fiducials with confidence indication/limits to ensure accurate slice placement and/or pause automation
- Configurable trench cuts for flexible re-deposition management
- Drift-Corrected-Frame-Integration (DCFI) within A S&V acquisition limits effects of system or sample instability
- Recoverability and continuation if an error condition is encountered
- Active feedback through email notifications (on pause, fault with reason, successful completion or user abort when connected to a mail server)
- Project/Job management to save, export and import project parameters for quicker setup of routine processes
- Graphic "end of run" reporting is provided to monitor automation
- Low vacuum electron beam imaging and drift suppressed milling are supported for low vacuum enabled instruments (Quanta 3D FEG) to facilitate investigation of non-conductive sample volumes

Applicable tools:	Helios 450, 450S, 650 and 600i, requiring xT control software version 4.5.2 Helios NanoLab (600), 400 and 400S, requiring xT control software version 3.8.7 Quanta 3D FEG (600), requiring xT control software version 3.6.11 Nova NanoLab* 200 600 and 600i, requiring xT control software version 3.8.8 Scios requiring xT control software version 7.x Strata* 400 and 400S, requiring xT control software version 3.8.8 Versa 3D HiVac / LoVac, requiring xT control software version 6.x
System software:	The system must be using PIA imaging hardware (which requires an upgrade from the shipped configuration for marked (*) systems).
Requirements:	The AutoSlice and View G3 option requires presence of Platinum or Carbon deposition gas chemistry.

FP 6842/22 Beam Deceleration

The Beam Deceleration option enables adjustment of the landing energy of the electron beam on the sample for conductive and partially conductive samples. The option contains a Stage modification to be compatible with negative voltage of 4 kV in Beam Deceleration Mode (BDM) and required electronics (power supplies, wiring, software control, etc.). This option improves low kV aberrations and thus the contrast can be increased at low kV for some samples.

Note:
For BDM, it is necessary to use a suitable detector, such as the In-column Detector (ICD), SSBSED detector,(retractable) Quad BSED, Retractable DBS or the Low-voltage, (retractable) High-contrast Detector (vCD).

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1046308 In-Column Detector (T3)
The In-column detector (ICD) is a scintillation-based detector which can be used for both SE and BSE detection, dependent on the imaging conditions chosen. This detector is especially suited for low_kV, low-energy, secondary electron detection giving advanced surface sensitivity, especially at short working distances.

1049668 Retractable STEM 3 Detector
The STEM 3 detector has eight individual channels: three concentric, ring-shaped segments, of which the outer is divided into six segments. The retractable STEM 3 detector enables scanning transmission imaging in bright field, dark field and high-angle dark field modes. With the retractable STEM 3 detector there is no need to vent the chamber to insert or remove the detector. The detector includes a row holder that can hold up to six TEM grids and which is compatible with the standard system holder.

This detector is suitable for the Scios. It requires the presence of a Solid State Detector Integration kit (1050488).

1041650 STEM 3+ Option
The retractable STEM 3+ detector enables scanning transmission imaging on thin samples in SEM and DualBeam instruments. It consists of three concentric, ring-shaped sections:

- Inner section - for bright field imaging
- Intermediate section - sub-divided in four annular rings, for tunable dark-field imaging and enhanced compositional contrast
- Outer section - sub-divided into six angular segments, for high angle dark field imaging

The microscope's control software supports easy switching between imaging modes and the display of up to four STEM signals simultaneously. With the retractable STEM 3+ detector there is no need to vent the chamber to insert or remove the detector. The detector includes a special sample holder that will allow STEM imaging for up to six TEM grids and which is compatible with the UMB holder.

This Retractable STEM3+ detector is available for Scios systems. It requires the presence of a Solid-State Detector integration Kit (1050488).

1050488 Solid-state Detector Integration Kit
Integration kit required to enable the interfacing of one or more solid state detector such as the STEM and DBS detector.

1049665 Nav-Cam+
The Nav-Cam+ is a color optical camera for Scios, mounted directly to the chamber for acquiring an image of samples mounted on the specimen stage. The Nav-Cam+ is optimized to capture images at the analytical working distance when the system is under vacuum so areas of interest can be found and investigated.

Images of samples can be easily captured when the user starts the sequence. The system incorporates sample lighting and a fully integrated, software-based capture control to ensure easy operation for high-quality images. The resulting image is acquired by moving the stage to a predefined location where approximately a 160 x 105 mm field-of-view is captured. The resulting image (with a resolution of 3072 by 2048 pixels or approximately six megapixels) can be digitally zoomed within the user interface to locate and move to specific sample locations. It is possible to save the Nav-Cam+ image file within the microscope control software with or without the current-location-marker-overlay (on the display) to document sample features or areas without the need of an additional external camera or annotation software.

FP 2311/05 Manual User Interface USB
Optional, supplementary control console providing direct manual control of microscope parameters such as focus, magnification, contrast, brightness, beam shift and stigmator.

1018263 Windows 7 Support PC

The support computer enables the user to grow with the speed of computer peripheral innovations during the lifetime of the system, without affecting the microscope controller and endangering system uptime. The support computer is a second PC, which connects to the microscope controller with an Ethernet connection taking over the data management task from the microscope controller (which remains dedicated to microscope operation).

The sample data management solutions enabled by the support computer are:

- It is possible to use the support computer for hosting 3rd party software/hardware that is not part of the microscope (*e.g.* MsOffice, CorelDraw) or for gaining performance for the microscope controller.
- The support computer has a video adapter to connect two monitors for having multiple applications visible that makes it easier to work with.
- The support computer has a second Ethernet card to connect to the LAN or WWW. Local IT departments have access to the support computer for (external) network configuration purposes. Internal networking (to the microscope controller) remains the responsibility of FEI.
- The support PC is equipped with a DVD+/-R/RW (including software).
- The support computer may be loaded and/or upgraded with the user's preferred anti-virus software, office-suite, printer drivers, email and Internet browser software.
- The computer is delivered with a 24'' widescreen LCD monitor and a software-controlled switchbox; this enables controlling the microscope controller and support computer by only one mouse and one keyboard. Switching between computers and monitors is fully controlled by the switchbox software.

Additional features of the support PC are:

- Equipped with the Microsoft Windows 7 operating system
- 12 GB RAM, 2.66 GHz Intel Xeon W3520 processor or higher
- The hard disk of the support PC has 500 GB or higher storage capacity
- 256 MB ATI FirePro V3700 graphics card or better
- Standard Midi-tower model

FEI's warranty and service responsibilities for the support computer are restricted to the delivered configuration, with service arrangements comparable to service arrangements offered by regular PC vendors.

9432 909 96411 Compressor 120 V, 60 Hz with 4-liter Tank

The compressor is required when compressed air of 6 atm. is not available; compressed air is required for operating pneumatic valves and the microscope's leveling system. The compressor is connected to the mains supply unit of the microscope.

FP 2301/12 Dual TEM Grid Holder

Dual TEM grid holder with 1/8 inch mounting pin.

1043821 Load Base

The Load Base is a tool for loading 3-mm TEM grids onto a row holder. These row holders can then be loaded onto one of the STEM Sample Holders. The Load Base is a mandatory item for various Retractable annular STEM detectors (PN's 1048761, 1048763, 1043815 and 1048538).

FP 3600/48 Universal Lift-out Holder

The universal lift-out holder allows for simultaneous mounting of sample stubs and TEM grids to facilitate lift-out methods in a DualBeam system. The holder accommodates standard FEI specimen stubs and TEM grids directly on the holder. With this holder, it is possible to reverse the direction of the clamping mechanism to accommodate an FEI TEM 6-grid row-bar holder (which is not included).

FP 2301/10 Specimen Holder Kit
The Universal specimen holder kit contains:

- One multi-specimen holder for up to 16 stubs;
- One analytical specimen holder accepting two 1'' analytical specimens (resin or epoxy embedded and polished) with constant height location of their upper surfaces, a built-in Faraday cage for probe-current measurements, and positions for two specimen stubs;
- One pre-tilt stub holder accepting two stubs at 45° and 90° pre-tilts;
- One interface adapter for the multi-specimen stub-holder and analytical holder with locating pins for consistent positioning onto the stage;
- One short (height 11.5 mm) single-stub holder accepting a standard 12 mm stub;
- One long (height 26.2 mm) single-stub holder accepting a standard 12 mm stub;
- Two wafer-piece holders (3 mm adapter pin, height 10 mm, slot 5 mm wide, the specimen being clamped between two screws);
- One 1'' specimen adapter;
- One 1.25'' specimen adapter;
- One adapter for fitting holders to previous-generation stages.

The 1'' and 1.25'' specimen adapters can be used to support analytical specimens on the single or multiple specimen holders. The specimen holder kit is supplied with two screwdrivers in a storage case.

9425 060 99100 North America on-site training, price per day
North America on-site training, per day, includes travel and expenses. Training includes basic operation and basic applications training for 2 to 4 people.

4022 400 43831 CIP Brno / Named place of destination in North America (T-3)
Carriage and Insurance Paid to named place of destination in North America Incoterms 2010. The Seller is responsible for the cost of freight up to the point where the goods are delivered to a specified destination. The risk of loss or damage passes to the Buyer at the moment the goods have been delivered to and put under the custody of the first carrier or Buyer. The Seller shall also procure insurance against Buyer's risk of loss or damage during transit. In accordance with FEI's standard terms and conditions of sale, title transfers at the same point that risk of loss transfers.

4022 404 41103 Installation Labor Scios NA
4022 404 02103 Installation Material Scios
Standard Installation labor and Material coverage - see Terms and Conditions

4022 404 43103 Warranty Labor Scios NA
4022 404 04103 Warranty Material Scios
Standard Warranty Labor and Material coverage - see Terms and Conditions

9425 061 69515 NA Installation Kit for Quanta (3D) FEG / Nova NanoSEM / Verios / Versa 3D / Scios

Part Number	Qty	SSD Supplied items
25066	1	External 10-inch water filter kit
1001224	1	Specimen stubs (20)
1020166	2	NIPPLE,SS,3/8BSPP-NPT
1020167	2	BARB,BRASS,3/8NPT
4022 293 39101	1	Damper assembly
4022 297 06181	5	8 mm Poly Tubing
4035 273 22521	1	Power strip, 6 out 220 IEC type
4035 273 43491	1	Chloramine-T algaecide (250 gram jar)
9425 061 69458	1	Auto Transformer 208V to 228V 7KVA
9425 061 69549	1	10 pack DVD+R x 10 - 4.7 GB Disks
9425 061 69585	2	50 ft. each - 3/8 inch Air Hose
9425 061 69586	8	Hose Clamps, Size 08
9425 061 69587	2	Brass Reducer ½”NPT – 3/8”NPT,
9425 061 69588	2	Brass Hose Barbs 3/8” NPT to 3/8” Hose
9425 061 69589	1	20A, 250 v Twist Lock Plug, Hubbell
9425 061 69590	2	½” KO Cable Clamp, Thomas & Betts
9425 061 69617	4	IEC Power cords, 6 ft.

<u>Choose a Chiller Type – air or water cooled</u>

9425 031 90501	1	Haskris RO33 Air Cooled Water Chiller
OR		
9425 031 90511	1	Haskris RO33 Water Cooled Water Chiller

FEI Company • 5350 NE Dawson Creek Drive • Hillsboro, Oregon 97124
Tel: 503-726-7500 • Fax: 503-726-2570

Terms and Conditions

Confirmation of Purchase Terms and Conditions of Sale

*Any order by the original buyer ('**Buyer**') of the goods and/or services ('**Product**') specified in this quotation ('**Quotation**') issued by or on behalf of FEI Company or its affiliate or subsidiary ('**Seller**') is subject to the following terms and conditions. Unless otherwise agreed, this Quotation is valid for 30 days from the date of issuance.*

1. **Scope.** The Quotation, including this Confirmation of Purchase Terms and Conditions of Sale, contains all agreements of the parties with respect to goods and services provided by Seller to Buyer ('**Agreement**'), supersedes all preceding quotations and is in lieu of all other agreements (oral or written), guarantees, promises, representations or warranties expressed or implied. This Agreement shall not be amended or revised by purchase order or other purchase document—it may be amended or modified only by a specific amendment referencing this Agreement executed by authorized personnel of the parties. ANY OFFER TO SELL IS EXPRESSLY LIMITED TO ACCEPTANCE OF ALL TERMS HEREIN, AND SELLER HEREBY SPECIFICALLY OBJECTS TO AND REJECTS ANY TERMS AND CONDITIONS OF BUYER'S OFFER THAT ARE IN CONFLICT WITH, DIFFERENT FROM OR IN ADDITION TO THESE TERMS AND CONDITIONS. THIS AGREEMENT SHALL BE BINDING ON SELLER ONLY AFTER ACCEPTANCE BY SELLER. IN THE EVENT THAT SELLER HONORS ONE OR MORE TERMS IN BUYER'S PURCHASE ORDER THAT IS (ARE) IN CONFLICT WITH THIS AGREEMENT, SUCH ACTION DOES NOT CONSTITUTE SELLER'S ACCEPTANCE OF ANY OTHER TERMS IN THE PURCHASE ORDER.

2. **Prices.** Except as otherwise noted, the quoted price includes site survey, installation, acceptance testing per Seller's standard acceptance procedures and comprehensive operations manual. Prices do not include any duties, freight, shipping, insurance or taxes unless specifically noted. Buyer shall pay such amounts directly or reimburse Seller for all such amounts, whether imposed on Buyer, required to be collected by Seller or imposed on the Product or Seller in connection with this sale (excluding taxes based on Seller's income).

3. **Payment Terms.** Invoices for Product will be issued as follows, each due thirty (30) days from the date of Seller's invoice:
   30 % of the purchase price invoiced upon receipt of order document from Buyer ('**Down Payment**');
   60 % of the purchase price invoiced upon Delivery (as defined in Section 7); and
   10 % of the purchase price invoiced upon acceptance (in accordance with Section 8) ('**Final Payment**').

Notwithstanding the foregoing, with respect to orders totaling less than US$100,000 (or local equivalent), 100% of the purchase price shall be due and payable without any deductions within thirty (30) days from the date of Seller's invoice, which will be issued by Seller upon shipment. Seller reserves the right to delay scheduling of installation until receipt of Down Payment. Payment for Seller-manufactured items cannot be withheld due to nonperformance, late delivery or inability to deliver third party items. In case of late payment, Buyer shall pay Seller interest on unpaid invoices at the rate of one and one-half percent (1½%) per month (but in no event greater than the maximum rate allowed under applicable law) for any amount payable by Buyer not paid when due under such invoices.

4. **Site Preparation; Installation.**

(a) Except as otherwise noted, Seller or its representative will install Product without charge, and at time of installation Seller will provide such testing, on-site training and operating and service manuals as it reasonably deems necessary. Seller will furnish all labor, material, tools and transportation and lodging for Seller's personnel for installation of the Product (not including third party items), and will provide Buyer with the installation site requirements.

(b) Buyer will furnish a safe and suitable place for installation of the Product in accordance with Seller's standard procedures, specifications and requirements, including without limitation suitable site, environment and room configuration, prior to delivery of the Product. If Buyer's site is not ready by the planned delivery date, or if the site does not meet Seller's published specifications, Seller is entitled to invoice Buyer for the Final Payment and any applicable storage, insurance and any additional accrued freight costs. Seller's service organization is available on request to perform pre-delivery site surveys and limited site consultation to verify Buyer's compliance with Seller's site requirements, provided however that responsibility for site compliance remains at all times with Buyer, and any site surveys performed and any consultation advice provided by Seller do not relieve Buyer of any responsibility for full compliance with Seller's requirements for suitable site, environment and room configurations. Upon two (2) weeks' advance notice, Seller or its representative will perform up to two (2) such site surveys at no additional charge to Buyer. Additional site surveys, if required, are available for an additional fee. In the event that subsequent to satisfying any

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specifications required hereunder, Buyer causes the condition of the site to change such that the Product no longer meets the specifications, Seller shall have no obligation to meet the specifications previously attained.

5. **Shipping.** Except as otherwise expressly agreed, transportation from Seller's factory shall be at Buyer's expense. Transportation charges shall be collect, or prepaid by Seller and billed to Buyer at Seller's option. Seller will arrange for insurance on Product while in transit, at Buyer's expense, if requested by Buyer. Shipping terms are **CIP .**

6. **Risk of Loss and Title Transfer.** Risk of loss or damage passes to Buyer in accordance with the Incoterm applicable to this order. Title transfers at the same point that risk of loss transfers. Buyer grants to Seller a security interest in the Product sold hereunder to secure the payment when due by Buyer of the purchase price and the performance by Buyer of its other obligations hereunder. Seller is authorized to file a financing statement in order to perfect its security interest in the Product. Buyer appoints Seller as its attorney to execute any documents or other instruments necessary to perfect and enforce Seller's security interest. Failure by Buyer to pay the purchase price when due, or otherwise to perform this Agreement, shall give the Seller the unlimited right, without liability, to take possession of the Product, with or without notice, and to have all of the remedies of a secured party under applicable law in addition to and not exclusive of other rights and remedies available to Seller under applicable law. The security interest shall remain with Seller, at Buyer's risk, until the purchase price and all other amounts payable by Buyer hereunder have been paid.

7. **Delivery.** Delivery as specified in the applicable Incoterm as set forth in Section 5 ('**Delivery**') shall be made in approximately _____ weeks.

8. **Acceptance.** Product will be deemed accepted on completion by Seller (or Seller's representative) of Seller's applicable published acceptance tests (which have been or will be provided to Buyer) or such other acceptance test that is expressly set forth in this Quotation. Any use of the Product by Buyer, its employees or agents prior to acceptance that delays acceptance of the Product will constitute Buyer's acceptance of the Product. If acceptance is delayed through no fault of Seller beyond sixty (60) days from Delivery, Seller reserves the right to invoice Buyer for the Final Payment. Buyer shall give Seller written notice of acceptance and such acceptance shall not be unreasonably delayed or withheld.

9. **Training.** Training, if any, specified in this Quotation is valid for use for twelve (12) months from the date of acceptance of the Product. Costs of travel and related expenses for Buyer's employees to and from the training location are Buyer's responsibility. Costs of travel and related expenses for Seller's employees performing training at Buyer's site will be borne by Seller. Any intellectual property or developments arising out of applications support, if any, specified in this Quotation shall be subject to the provisions of this Section 9 unless the parties have entered into a separate written agreement. The rights to any Intellectual Property (as defined below) developed by Seller (either solely or jointly with Buyer) in relation to the services provided shall vest with Seller unless explicitly agreed otherwise in separate written agreement signed by Seller. Buyer shall execute all documents reasonably required by Seller to evidence Seller's ownership in such Intellectual Property. Buyer is hereby granted free of charge a worldwide, irrevocable, perpetual license to such developed Intellectual Property for internal use in connection with the System. **'Intellectual Property'** means all present and future (a) patent rights, (b) copyrights, mask work rights, and other rights associated with works of authorship, (c) trade secret rights, and (d) other forms of intellectual or industrial property rights and proprietary rights of any kind or nature including rights under and with respect to all applications, registrations, extensions, and renewals of the foregoing. Except as provided herein and in the software license in Section 14, no other license rights are granted.

10. **Warranty.** Seller warrants to the original Buyer of Product manufactured by Seller that the Product will be free from material defects for a period of twelve (12) months from the date of acceptance or fourteen (14) months from the date of Delivery if installation is delayed through no fault of Seller, whichever occurs first ('**Warranty Period**'). Consumables will only be replaced under the warranty if they have failed prior to the end of their ordinary useful life (e.g., if an item has a 1000 hour life, and fails two months into the Warranty Period, but after 1100 hours of use, it will not be considered defective and will not be subject to replacement by Seller). Any Product repaired or replaced under this warranty is warranted only for the unexpired part of the original Warranty Period applicable to that Product. Warranties for third party items are the responsibility of the third party vendor, provided, however, that Buyer shall have the benefit of any pass-through warranties provided by any third party vendor to the extent available. The warranty set forth above ('**Warranty**'), if any, does not apply and shall be of no force and effect if Buyer (or Buyer's agents, employees or contractors) modifies, maintains or repairs Product with other than Seller-supplied parts and Seller-authorized personnel. In addition, the Warranty shall not apply to, and Seller shall have no responsibility for, defects caused in whole or in part by accident, vandalism, other than normal use, abuse, wrongful act, neglect, failure to use proper operational and safety procedures or improper integration, installation, application or maintenance. Seller's sole obligation under the Warranty is to provide one of the following remedies, in Seller's sole reasonable discretion: repair, replacement or removal and refund of purchase price. No modification of the Warranty shall be binding on Seller unless agreed to by Seller in a writing

referencing this Agreement signed by an authorized representative of Seller. In no event shall Buyer have the right to 'cover' by procuring substitute Product at the cost or expense of Seller. THE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS, IMPLIED OR STATUTORY, WITH RESPECT TO THE PRODUCT. NO WARRANTIES SHALL ARISE UNDER THIS AGREEMENT FROM COURSE OF DEALING, COURSE OF PERFORMANCE OR USAGE OF TRADE. SELLER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT AND FITNESS FOR ANY PARTICULAR PURPOSE.

11. **Maintenance.**

(a) Definitions: (i) '**Maintenance**' means the services provided by Seller or its representative under Seller's Maintenance Policy in effect at the time such services are ordered. (ii) '**Maintenance Fee**' means the annual fee charged Buyer by Seller for Maintenance. (iii) '**Maintenance Period**' means a period during which Seller makes Maintenance available (which is ordinarily a one-year, renewable period), except as otherwise specified by Seller. (iv) '**Maintenance Policy**' means Seller's Maintenance Policy regarding the applicable Product (which may differ by type of product and service level), initially as in effect on the date of this Quotation and as may be modified from time to time thereafter as set forth herein. The current Maintenance Policy for systems in the continental U.S. is available at www.fei.com/support/tc.aspx (for Product installed elsewhere, contact account manager for terms).

(b) Seller's standard level Maintenance services applicable to the Product, if any, will be provided to Buyer at no additional charge during the Warranty Period, if any. For as long as Seller provides Maintenance for the Product, Seller will make Maintenance available to Buyer for purchase. Seller reserves the right to alter its standard Maintenance Policy from time to time, but will not reduce the level of Maintenance during any Maintenance Period for which a Maintenance Fee has been paid. Seller makes available premium levels of Maintenance for many of its products and the price for such services can be quoted by Seller on Buyer's request.

12. **Liability.** IN NO EVENT SHALL SELLER OR ITS SUPPLIERS BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES ALTHOUGH SELLER MAY BE INFORMED OF THE POSSIBILITY OF SUCH DAMAGES IN ADVANCE. EXCEPT AS EXPRESSLY PROVIDED HEREIN, SELLER DISCLAIMS ALL OTHER LIABILITY TO BUYER OR ANY OTHER PERSON IN CONNECTION WITH THIS AGREEMENT OR THE DELIVERY OR NON-DELIVERY, SALE, MAINTENANCE, USE OR PERFORMANCE OF PRODUCT, INCLUDING SPECIFICALLY, BUT WITHOUT LIMITATION, LIABILITY FOR NEGLIGENCE OR STRICT LIABILITY IN TORT. NOTWITHSTANDING ANY OTHER PROVISION OF THIS AGREEMENT, IN NO EVENT SHALL SELLER'S OR SELLER'S SUPPLIERS' LIABILITY UNDER THIS AGREEMENT EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCT BY BUYER. BUYER ACKNOWLEDGES THAT THE PRICING OF THE PRODUCT AND THE OTHER TERMS AND CONDITIONS OF THIS AGREEMENT REFLECT THE ALLOCATION OF RISK SET FORTH IN THIS AGREEMENT AND THAT SELLER WOULD NOT ENTER INTO THIS AGREEMENT WITHOUT THESE LIMITATIONS OF ITS LIABILITY.

13. **Cancellation of Order.** If Buyer cancels the order prior to shipment, then Buyer shall pay Seller an amount determined from the following: (a) for standard Product: if cancellation notice is given 31-120 days prior to scheduled shipment date: 15% of total purchase price; 0-30 days prior to scheduled shipment date: 50% of total purchase price; (b) for non-standard Product: if cancellation notice is given 31-120 days prior to scheduled shipment date: 50% of total purchase price; 0-30 days prior to scheduled shipment date: 75% of total purchase price. Because of the difficulty of determining Seller's actual damages upon cancellation by Buyer, Seller and Buyer agree that the above amounts are reasonable estimates of actual damages and constitute liquidated damages and not penalties.

14. **Software License.** '**Software**' means all operating programs or applications programs, including any updates and parts thereof, incorporated into or included with Product sold to Buyer, whether expressed in object code, source code or otherwise. Subject to the payment of all fees due hereunder, Seller hereby grants Buyer a nonexclusive, nontransferable (except as set forth below) license to use Software, if any, in the Product in which the Software is first installed, subject to the provisions of this section. The warranty applicable to the Software, if any, is as described in Section 10. Seller does not warrant that (i) the Software will meet Buyer's requirements, (ii) the Software will operate in combination with other hardware, software, systems or data not provided by Seller (except as expressly specified in the documentation provided with the Product), (iii) the operation of the Software will be uninterrupted or error-free, or (iv) all Software errors will be corrected; provided, however, that if Buyer is current on Maintenance Fees, Seller shall be obligated to provide Maintenance. Third party software may be subject to additional license rights and restrictions as set forth in the documentation and/or license agreements included with such software. Software and documentation is copyrighted, and FEI Company and its licensors retain exclusive right, title and interest in and to the Software and all copies, translations, modifications, improvements, enhancements, updates or portions thereof, including all intellectual property rights. In order to protect such intellectual property rights and preserve the confidentiality of the Software, Buyer may not decompile, reverse engineer, disassemble or otherwise reduce the Software to a human-perceivable form, except to the extent expressly permitted by mandatory provisions of any third party license or applicable law (including national laws

implementing Directive 91/250/EEC on the legal protection of computer programs) in order to gain certain information specified therein, provided that Buyer shall not exercise its rights under such laws unless and until Buyer has first requested the required information from Seller in writing, and Seller, at its sole discretion, has not complied with Buyer's request within a commercially reasonable period of time. Buyer may not alter, adapt, translate, modify, network, rent, lease, loan, distribute or create derivative works based upon the Software, in whole or in part except to the extent permitted by the mandatory provisions of any third party licenses. Buyer shall not remove, alter or obscure any proprietary notices from any part of the Software or documentation. Licensors of third party software that may be included in the Software have all the rights and benefits of Seller under this Agreement, and, to the extent permitted by applicable law, shall have no liability for any damages, whether direct, indirect, incidental or consequential, arising from the use of such third party software. Buyer shall not make Software available in any form to any third party, except that—provided such third party agrees to be bound by the provisions of this license—Buyer may transfer the Software to a third party ('**New User**') that purchases, leases or acquires title to (A) the Product in which the Software was originally installed for use in/with that Product or, (B) for Software that can operate independently of FEI Company hardware, the rest of the Product with which the Software was purchased. Buyer is only entitled to transfer the Software to a New User if (a) Buyer has completely relinquished the use of the Software, (b) Buyer has destroyed any existing copies of the Software, and (c) Buyer has notified Seller in writing of the name and address of the New User. Buyer is responsible for implementing reasonable means to monitor its compliance with the terms of this Agreement. At Seller's written request, but not more frequently than once annually, Buyer shall certify to Seller in a writing signed by Buyer's authorized representative its compliance with the terms of this license, and listing (1) the number of people to whom Buyer provides access to the Software, and (2) the locations and types of the systems on which it operates or has installed the Software. Seller reserves the right (directly or via a third party) to audit Buyer's use of the Software no more than once annually at Seller's expense. Such audit shall be only upon advance notice and in a manner that does not unreasonably interfere with Buyer's business activities. If such audit reveals that Buyer has underpaid fees to Seller, Buyer shall promptly pay to Seller such fees at the prices previously agreed to for such Software and, if the underpayment is greater than ten percent (10%), Buyer shall reimburse Seller for its reasonable costs of audit. The Software and documentation are provided with Restricted Rights. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in this License and in DFARS 227.7202-3 or FAR 52.227-19, as applicable. Manufacturer is FEI Company, 5350 NE Dawson Creek Drive, Hillsboro OR 97124.

15. **Force Majeure.** In addition to any excuse provided by applicable law, Seller shall be excused, and free from liability for, any non-delivery, delay in delivery or failure otherwise to perform arising out of any event beyond Seller's reasonable control, whether or not foreseeable by either party, including, but not limited to, labor disturbance, strike, war, fire, accident, adverse weather, inability to secure transportation, governmental act or regulation, inability of Seller to obtain raw materials, denial of export license and other causes or events beyond Seller's reasonable control, whether or not similar to those enumerated above.

16. **Confidentiality.** Buyer shall keep confidential all confidential and proprietary information of Seller, including, but not limited to, the Product, Software, documentation, formulas, methods, designs, know-how, processes, new products, developmental work, marketing requirements, marketing plans, customer names, prospective customer names, the terms and pricing under this Agreement and the results of any comparative or other benchmarking tests with respect to the Product, in each case regardless of whether such information is identified as confidential ('**Confidential Information**'). Confidential Information shall include (i) any information that is clearly identified in writing at the time of disclosure as confidential, (ii) any information that, based on the circumstances under which it was disclosed, a reasonable person would believe to be confidential, or (iii) all information of third parties that Seller is obligated to treat as confidential. Buyer shall not to make Confidential Information available in any form to any third party or to use Confidential Information for any purpose other than in the performance of this Agreement. Buyer shall take all reasonable steps to ensure that Confidential Information is not disclosed or distributed by its employees or agents in breach of this Agreement. Seller shall be entitled to seek immediate injunctive relief, in addition to whatever remedies it might have at law or under this Agreement, for any violation of this provision. The aforesaid obligations shall not apply to Confidential Information, which (a) is or becomes generally available to the public without Buyer being responsible for such disclosure; (b) becomes available to Buyer on a non-confidential basis from a third party which was not itself bound by a confidentiality obligation and was entitled to disclose the information; (c) has already been known by Buyer prior to its disclosure under this Agreement without an obligation of confidentiality.

17. **Miscellaneous.**

(a) This Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective permitted successors and assigns, provided, however, except as expressly set forth herein, neither party shall have the right to assign or transfer in whole or in part, by operation of law or otherwise, its rights or obligations hereunder without the consent of the other party.

(b) If any term or provision of this Agreement or the application to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this Agreement, or the application of such term or provision to persons or circumstances other than those to which it is held invalid or unenforceable, shall not be affected thereby, and each such term and provision of

this Agreement shall be valid and shall be enforced to the fullest extent permitted by law.

(c) All notices required to be sent hereunder shall be in writing and a notice shall be deemed to have been given upon (i) the date sent by confirmed facsimile, (ii) on the date it was delivered by recognized express courier or by hand delivery, or (iii) if by certified mail return receipt requested, on the date received.

(d) No waiver of any provision of this Agreement shall be deemed, or shall constitute a waiver of any other provision, whether or not similar, nor shall any waiver constitute a continuing waiver. No waiver shall be binding unless executed directly by the party making the waiver.

(e) If an action, suit or proceeding is commenced to enforce this Agreement or with respect to this Agreement, the prevailing party shall be reimbursed by the other party for all costs and expenses incurred in connection with the action, suit or proceeding, including without limitation reasonable attorneys' fees at the trial level and on any appeal.

(f) Buyer will comply with applicable export laws.

(g) This Agreement has been drafted in English, at the express request of the parties.

18. **Reference.** With prior approval of Buyer, which Buyer shall not unreasonably withhold, Seller may identify Buyer as a user of Seller's products or services in: (i) communications with other customers, potential customers, industry analysts, financial analysts and the like; and (ii) in press releases, sales materials, sales brochures, advertising, on the FEI Company website and in other similar ways. Further, Buyer will serve as a reference account for Seller upon Seller's request and will make its personnel reasonably available for communications with other customers and potential customers concerning use of Seller's products and solutions.

19. **Governing Law.** This Agreement shall be governed by the laws of the State of Oregon, including without limitation its Uniform Commercial Code but excluding its conflict of laws rules. Notwithstanding the foregoing, if Buyer's principal place of business is in Canada, this Agreement shall be governed by the laws of the Province of Ontario, Canada. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement or sales made pursuant hereto.

Quotation Acceptance

FEI Account Manager Dean Krogman
Phone +1 608.358.2455
Email Dean.Krogman@fei.com

To accept this Quotation, please sign below, and fax this page along with your purchase order to your Account Manager listed above. The terms and conditions in this Quotation supersede and replace the terms in any previously sent Quotation and in any of your purchase orders relating to this order, and will exclusively control and govern the rights and obligations of FEI and your entity with respect to this order (any additional or different terms contained in your purchase order will not be binding upon FEI and are expressly deemed rejected). FEI will send you an order acknowledgement upon FEI's receipt and acceptance of this Quotation Acceptance Form.

Agreed and accepted:

Name of Purchasing Entity _____

Authorized Signature _____

Signed By Name _____

Date _____

Please Send Purchase Order To:

FEI Company
5350 NE Dawson Creek Drive
Hillsboro, Oregon 97124
Tel: 503-726-7500 Fax: 503-726-2570

Arturo Ponce-Pedraza

From: Mike Craig <mike.craig@tescan-usa.com>
Sent: Sunday, March 30, 2014 3:26 PM
To: Arturo Ponce-Pedraza
Cc: Drew Erwin
Subject: TESCAN FIB-SEM Information Request
Attachments: 2013_05 - LYRA VELA - Preview.pdf; 2013_05 - FERA3 - Preview.pdf

Dr. Ponce,

Thank you for your inquiry regarding our FIB-SEMs.
I am the new sales manager for TESCAN in Texas and will be happy to answer your questions.
Here is a brief summary of the three models of FIB-SEMs we have to offer:

VELA3 - W-source SEM column w/ Ga source FIB (Canion or COBRA +$ 67 k); base price around $ 583 k to 680 k USD.
LYRA3 - Shottkey FE-source w / Ga source FIB (Canion or Cobra + 67 k); base price $ 678 k - 775 k.
FERA3 - Shottkey FE-source w/ Xe Plasma source FIB, base price $ 1.25 M - 1.35 M.

We have two basic chamber sizes to choose from:

XM - samples to 185 mm diameter, 12 ports.
GM - samples to 230 mm diameter, 20 ports.

We also offer a low-vacuum option for charge dissipation, as well as TOF-SIMs.
The systems can be equipped with EDS, WDS, CL, STEM, EBSD, and many more.
It would probably be a good idea to discuss your research to ensure we have the proper configuration.
I would welcome the chance for us to get together to discuss your specific research objectives.
Please let me know, as I live in Austin and would enjoy meeting you and seeing your facility.

I've attached a brochure for each model containing basic specifications as well as options.
We are happy to run samples and/or welcome you to a live demonstration.

Please let me know if you have any questions.

Best regards,

Mike Craig
Regional Sales Manager
South Central Region
TESCAN U.S.A. Inc
Phone: (512) 417-8990
E-mail: mike.craig@tescan-usa.com
Please visit our website: www.tescan-usa.com

Appendix C
Sole Source from Zeiss
(6 pages)

Zeiss Auriga CrossBeam Sole Source Specifications
Professor Arturo Ponce - UTSA

Auriga Unique Differentiators

AURIGA CrossBeam Workstation

Zeiss Auriga CrossBeam Sole Source Specifications
Professor Arturo Ponce - UTSA

Confidential

The following is a short summary of some of the unique characteristics and advantages of the Zeiss Auriga 40 CrossBeam, a state of the art FIB/FESEM system proposed to Professor Arturo Ponce at the University of Texas at San Antonio.

AURIGA CrossBeam: The AURIGA CrossBeam Workstation provides the most versatility of any FIB+SEM platform, a high resolving FESEM instrument with stability for all analytical applications and the best resolution COBRA ion column for milling. The AURIGA CrossBeam features a Complete Detection System (CDS) which enables simultaneous surface, compositional and crystallography imaging down to the nanometer level with high signal contrast and unsurpassed clarity. This makes it an ULTRA high end FESEM + FIB for all applications in Material Science, Life Science and in the Semiconductor world. With the full integration of detectors on the AURIGA, such as EsB (Energy Selective Backscatter, In-lens Secondary Electron, and chamber mounted 4Q BSD and Everhart Thornley detectors combined with the industry leading Gemini FESEM electron optics design, this creates a wholesome differentiator environment ideal for all classes of sample materiel.

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- **Pneumatic Insertion:** Pneumatic insertion of our 4Q- backscatter detector, STEM detector is standard functionality and "unique" to the Carl Zeiss AURIGA CrossBeam. The aforementioned requires no physical insertion by the end user adding to the ease of use advantage of this instrument.

- **Gemini Electron Optic Design:** The most significant differentiator of the Carl Zeiss AURIGA CrossBeam is the GEMINI column. It is the only Crossover free electron optic design and provides ‘Best in Class” ease of use and performance. The GEMINI column integrates a beam booster as an integral part of the electron optical column. The beam booster always maintains a high beam energy through-out the entire column, regardless of the electron beam energy selected by the operator. We also incorporate the only "On Axis" in lens SE and BSE detectors.

ZEISS

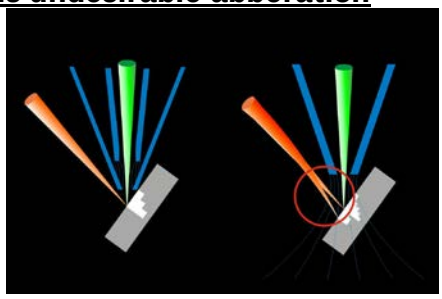
- **In-Lens Detection**

  Our Gemini column features a dual set of *on-axis in-lens detectors*. The on-axis secondary electron detector maximizes contrast and efficiency while maintaining a true optical projection. This benefit is also used by the upper in-lens backscatter (EsB) detector This combines unique , extreme low voltage BSE imaging with minimum edge effect, minimum topographic contrast, and extremely high Z contrast. Unlike a traditional backscatter detector, the EsB separates high energy BSE1 from lower resolution BSE signals. This combined with the small interaction at low voltage produces an inherently high-resolution signal.

- *Live viewing during milling*- The EsB is insensitive to the secondary electrons generated by both the ion beam and the electron beam. This means that you can maximize material contrast during live milling which will greatly enhance 3D reconstruction, failure analysis and end point detection. EsB contrast can be viewed simultaneously on the dual monitors with the ion beam and the electron beam induced secondary electron signals.

  The in-lens SE signal during live milling is an ultra-high resolution complementary signal with a unique hybrid contrast observed for crystalline materials created by the mixing of ion beam induced channel contrast and electron beam induced secondary electrons.

- **High Resolution Milling:**
  Gallium split occurs in magnetic field, but not in Zeiss system (electrostatic lens). The Zeiss system is only system available that does not exhibit this undesirable abberation



  Isotopes are atoms of a chemical element whose nuclei have the same atomic number (number of protons) but different atomic weights. The difference in atomic weights results from differences in the number of neutrons in the atomic nuclei. Consequently, these different charged Gallium isotopes with different weights will bend to different extents under a magnetic field, due to the effect of a force having different effects on particles of different masses. The bending force being equal to F = q v x B (q = charge, v = velocity, B = magnetic lens strength).

So, under constant magnetic lens strength, a heavy isotope's trajectory will bend less than a lighter isotopes trajectory. It turns out that this is the principle of a cyclotron, in which you shoot charged particles into a magnetic field and measure the circular radii of their trajectories in order to determine their masses.

The Zeiss system has an electrostatic lens and therefore all the Gallium isotopes travel together and are not separated by a magnetic field and consequently your **beam spot size will be smaller.**

Dual FIB and SEM image display- The digital scan generator allows simultaneous display of an electron beam induced secondary electron image on one display and an ion beam induced secondary electron image on the second display. Scanning modes are independent.

- **Best in Class COBRA Ion Column:** The AURIGA CrossBeam COBRA ion column provides FIB resolution better than 2.5nm; for most accurate patterning and thinnest serial sectioning. The COBRA provides beam currents from 1pA (finest milling) and 50pA for rapid cross-section and TEM sample preparation. Combined with the Zeiss Gemini optics, Maximum Information – Maximum Insight.

- **Ferromagnetic Imaging:** Ferromagnetic Materials at high resolution can be imaged to the fullest capability of the columns performance. This is because the Gemini column utilizes an electrostatic field below the lens, very different from other designs that use a strong magnetic field below the lens for high resolution. There are also **no** "Special Modes" of operation necessary. Some other FESEM designs need to switch into modes such as an "Analytical Mode" a "Low magnification" to "High magnification mode." The AURIGA is always in high resolution mode and when a user needs to perform EDX, one simply needs only to turn the spectrometer on. Magnification is also continuous.

- **Environmental Tolerance:** The high beam energy throughout the column of the AURIGA CrossBeam ensures that the GEMINI column is extremely well protected against magnetic stray fields, even when operated at very low voltages. The magnetic stray field specification of the AURIGA is 3 MG peak to peak through the entire accelerating voltage range. In comparison, some other SEM+FIB instruments will only tolerate 0.5 to 1 MG, peak to peak of magnetic stray fields in an environment. As most rooms typically have at least 1 MG of stray EM fields, the AURIGA will ensure the best EM protection in poor environments.

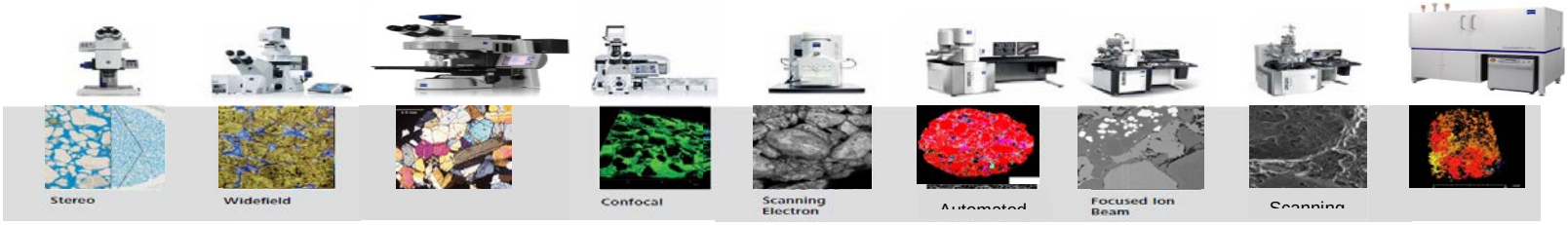
- **Class Leading Analytical Geometry:** The AURIGA CrossBeam provides the optimum geometry for x-ray (EDS) analysis, EBSD and ion milling of any SEM+FIB, by placing access to the specimen as a design priority. The objective lens features a sharp profile that allows a 5mm analytical working distance and 35 degree x-ray take-off angle while at the e-beam / ion beam coincidence point. The class leading analytical working distance and high take-off angle are perfect for high resolution, high current, and imaging with full quantitative EDS or WDS. What's more, the

analytical working distance can be varied up to 20mm to suit applications such as EBSD or large specimens.

- **Image Navigation:** Digital images of the specimen can be imported for navigation. The navigation image can be obtained from any source e.g., a digital camera, USB web-cam or CAD schematic. By double-clicking a feature on the navigation image, the stage will place that part of the specimen in the centre of the field of view within <100µm.

  - ***Correlative Microscopy of all imaging techniques (LM, EM & XRM) with SmartBrowse for contextual BSE, SE & EDX data***

    Benefit –
    a) Correlate polarized light microscope images from Zeiss Confocal and/or stereo microscopes already at UTSA
    b) Combine optical texture information with chemical information and extend into 3D



- **Serviceability / Support:** Local Service support will be provided from our Austin based engineering staff managed by Mr. Tim Blade, Central Region Service Manager (also based in Austin). Tim has 4 Texas based Field Service Engineers who have extensive knowledge with electron / ion beam service background and experience.

German Neal

German Neal

Carl Zeiss Microscopy LLC
One Zeiss Drive
Thornwood, NY 10594

Cell 646-460-1605
E mail german.neal@zeiss.com

Appendix D
Purchase Order from UTSA
(12 pages)

Purchase Order

UTSA
The University of Texas at San Antonio
One UTSA Circle
San Antonio TX 78249
United States

Dispatch Via Print		
Purchase Order UTSA1-0000000030	**Date** 2014-05-08	**Revision**
Payment Terms Net 30 Day	**Freight Terms** FOB Destination	**Ship Via** Best Avail
Buyer Mariano Alaniz	**Phone** 210/458-5077	**Currency** USD

Vendor: 0000028791
CARL ZEISS
MICROSCOPY LLC
1 ZEISS DR
THORNWOOD NY
105941939
United States

Ship To: CR10104
UTSA
CENTRAL RECEIVING
WAREHOUSE
One UTSA Circle
San Antonio TX 78249
United States

Attention: Not Specified

Bill To: UTSA
Disbursements and
Travel Services
One UTSA Circle
San Antonio TX 78249
United States

Tax Exempt? Y **Tax Exempt ID:** TEXAS STATE AGENCY **Replenishment Option:** Standard

Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date
1 - 1	Item Description: ITEM# 3495999001055000		1.00	EA	632700.00	632700.00	05/08/2014
					Schedule Total	632700.00	
	Basic Unit Crossbeam 340 Shall include: FE-SEM GEMINI electron optics Large chamber with 18 accesory ports, auto pendulum anti vibration system, 6-axes motorized super-eucentric stage, Chamber-SE and In-lens SE detector, Specimen current monitor, sample holder, and two (2) 24" TFT monitors.						
					Item Total	632700.00	
2 - 1	ITEM# 3495609001000000		1.00	EA	376200.00	376200.00	05/08/2014
	Capella FIB column, Shall include: Resolution at 30 kV: 3nm. Voltage Range: 500V - 30 kV. Probe current range: 1 pA - 100 nA. Motorized high precision aperture changer, Electrostatic beamblanker.				**Schedule Total**	376200.00	
					Item Total	376200.00	

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Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date
3 - 1	ITEM# 3495619500000000 Multi GIS		1.00	EA	145350.00	145350.00	05/08/2014
					Schedule Total	145350.00	
					Item Total	145350.00	
4 - 1	ITEM# 3495549001000000 AL80 P Carl Zeiss Airlock with 80 mm gate valve		1.00	EA	44460.00	44460.00	05/08/2014
					Schedule Total	44460.00	
					Item Total	44460.00	
5 - 1	ITEM# 3482246102000000 Software License AUTOPREP.		1.00	EA	34200.00	34200.00	05/08/2014
					Schedule Total	34200.00	
					Item Total	34200.00	
6 - 1	ITEM# 3495069005000000 4QBSD-Pneumatic-Smart P Pneumatic retractable 4 Quadrant solid state BSE-detector		1.00	EA	28215.00	28215.00	05/08/2014
					Schedule Total	28215.00	
					Item Total	28215.00	
7 - 1	ITEM # 3495069015000000 aSTEM detector smart,assembly kit		1.00	EA	33345.00	33345.00	05/08/2014
					Schedule Total	33345.00	
					Item Total	33345.00	

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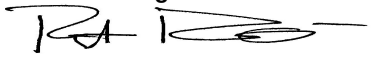

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Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date
8 - 1	ITEM # 3478058018100000 STEM on EBSD-Port, complete		1.00	EA	1368.00	1368.00	05/08/2014
					Schedule Total	1368.00	
					Item Total	1368.00	
9 - 1	ITEM# 4107901004000000		1.00	EA	9800.00	9800.00	05/08/2014
					Schedule Total	9800.00	
	Four (4) day advanced applications training class for FIB/SEM or Ion Microscopy at customer's site. Class will be customized to customer's needs and include all training materials and handouts. Classes will be conducted by an Applications Specialist. Travel expenses are included.						
					Item Total	9800.00	
10 - 1	ITEM # 3482246105000000		1.00	EA	6075.00	6075.00	05/08/2014
					Schedule Total	6075.00	
	Software License ORS Visual SI Visual SI 3D reconstruction and visualization software package Shall included annual maintenance for the first year from installation.						
					Item Total	6075.00	
11 - 1	ITEM# 3460239011140000 Control panel with rotary controls and keyboard.		1.00	EA	5775.00	5775.00	05/08/2014
					Schedule Total	5775.00	
					Item Total	5775.00	

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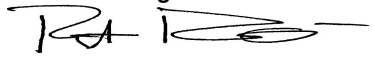

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Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date
12 - 1	ITEM# 4107133001000000 ThermoCube Air-cooled Liquid Chiller		1.00	EA	4250.00	4250.00	05/08/2014
					Schedule Total	4250.00	
					Item Total	4250.00	
13 - 1	ITEM# 3478239117100000 X-Ray/External Scan Input Panel Kit C/w		1.00	EA	3249.00	3249.00	05/08/2014
					Schedule Total	3249.00	
					Item Total	3249.00	
14 - 1	ITEM# 3495209031000000 20nA VP GI 20nA High resolution configuration for VP systems GEMINI I		1.00	EA	2565.00	2565.00	05/08/2014
					Schedule Total	2565.00	
					Item Total	2565.00	
15 - 1	ITEM# 3482246030000000 Compucentric Stage Software License		1.00	EA	1901.00	1901.00	05/08/2014
					Schedule Total	1901.00	
					Item Total	1901.00	
16 - 1	ITEM# 3482246062000000 Software License for Dual Channel Operation for MERLIN.		1.00	EA	1324.00	1324.00	05/08/2014
					Schedule Total	1324.00	
					Item Total	1324.00	

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17 - 1	ITEM# 3482246003000000 Dual Magnification Software		1.00	EA	1275.00	1275.00	05/08/2014
					Schedule Total	1275.00	
					Item Total	1275.00	
18 - 1	ITEM# 3478058042000000 4Q BSD port adapter AURIGA and AURIGA 60		1.00	EA	616.00	616.00	05/08/2014
					Schedule Total	616.00	
					Item Total	616.00	
19 - 1	ITEM# 3478239056000000 Operating system Windows w/ keyboard		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	
20 - 1	ITEM# 3465618077000000 Reservoir Pt		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	
21 - 1	ITEM# 3465618071000000 Reservoir C14H10		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	
22 - 1	ITEM# 3465618070000000 Reservoir W(CO)6		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	

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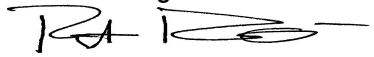

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23 - 1	ITEM #3465618075000000 Reservoir (CH3)2(C5H7O2)Au(III)		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	
24 - 1	ITEM# 3465618080000000 Reservoir SiO2 (BDAC)		1.00	EA	0.00	0.00	05/08/2014
					Schedule Total	0.00	
					Item Total	0.00	
25 - 1	ITEM# ~3001760 Oxford/Omniprobe SDD EDX and AutoProbe 200 AZtecEnergy Standard Microanalysis System with X-MaxN 50 large are Analytical Silicon Drift Detector OmniProbe 200 Nanomanipulator		1.00	EA	75000.00	75000.00	05/08/2014
					Schedule Total	75000.00	
	Will Include: X-MaxN 50 SDD detector with PentaFET Precision, MicsF, Xstream2, ASSY-0001.16.00 Metal probe shaft, Omiprobe 200 software package, Starter pack 200 **Open Market Purchase**						
					Item Total	75000.00	
26 - 1	Discount		1.00	EA	-675456.00	-675456.00	05/08/2014

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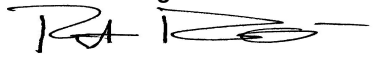

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Buyer Mariano Alaniz	**Phone** 210/458-5077	**Currency** USD

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Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date
					Schedule Total	-675456.00	
					Item Total	-675456.00	
27 - 1	Shipping Charges		1.00	EA	2200.00	2200.00	05/14/2014
	** No To Exceed $2,200.00**						
					Schedule Total	2200.00	

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WARRANTY AND MATERIAL DEFECTS

CONTRACTOR WARRANTS AND REPRESENTS THAT ALL PRODUCT COVERED
BY THIS BID AND RESULTING AGREEMENT SHALL BE NEW, MERCHANTABLE, FIT FOR THE PURPOSE INTENDED, OF BEST QUALITY AND WORKMANSHIP, AND FREE FROM ALL DEFECTS. CONTRACTOR AGREES THAT IT WILL, AT ITS OWN COST, CORRECT ALL MATERIAL DEFECTS IN THE PRODUCT AS SOON AS PRACTICAL AFTER CONTRACTOR BECOMES AWARE OF THE DEFECTS. UTSA SHALL HAVE THE RIGHTS OF INSPECTION AND APPROVAL AND MAY REJECT AND RETURN GOODS OR REQUIRE REDELIVERY OR REMEDY OF PRODUCT AT CONTRACTOR'S EXPENSE IF PRODUCT IS DEFECTIVE OR NOT IN COMPLIANCE WITH UTSA'S SPECIFICATIONS. CONTRACTOR'S DEFAULT IN PROMISED DELIVERY OR FAILURE TO CONFORM TO THE REQUIREMENTS OF THE AGREEMENT AUTHORIZES UTSA TO PURCHASE GOODS OR SERVICES ELSEWHERE AND CHARGE TO CONTRACTOR ANY EXCESS COST OF SUCH REPURCHASE. DEFECTS SHALL NOT BE DEEMED WAIVED BY UTSA'S FAILURE TO NOTIFY CONTRACTOR UPON RECEIPT OF GOODS OR COMPLETION OF SERVICES OR BY PAYMENT OF INVOICE. THIS REMEDY IS IN ADDITION TO, AND NOT IN SUBSTITUTION FOR, ANY OTHER REMEDY FOR DEFECTIVE PRODUCT THAT UTSA MAY HAVE AT LAW OR IN EQUITY.

QUANTITIES

UTSA ANTICIPATES PURCHASING THE QUANTITIES LISTED IN THE QUOTATION. HOWEVER, UTSA RESERVES THE RIGHT TO INCREASE OR DECREASE THE QUANTITIES OF ITEMS PURCHASED UNDER THIS CONTRACT BY ANY AMOUNT. UTSA RESERVES THE RIGHT TO PURCHASE ADDITIONAL QUANTITIES, IF AND WHEN NEEDED, AT THE SAME BID PRICE DURING THE CONTRACT PERIOD.

INSURANCE

IN THE EVENT THE VENDOR, ITS EMPLOYEES, AGENTS OR SUBCONTRACTORS ENTER PREMISES OCCUPIED BY OR UNDER THE CONTROL OF UTSA IN THE PERFORMANCE OF THE AGREEMENT, THE VENDOR AGREES THAT IT WILL MAINTAIN PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE IN REASONABLE LIMITS COVERING THE OBLIGATIONS SET FORTH ABOVE, AND WILL MAINTAIN WORKER'S COMPENSATION COVERAGE (EITHER BY INSURANCE OR IF QUALIFIED PURSUANT TO LAW, THROUGH A SELF-INSURANCE PROGRAM) COVERING
ALL EMPLOYEES PERFORMING THE AGREEMENT ON PREMISES OCCUPIED
BY OR UNDER THE CONTROL OF UTSA.

Contractor Personnel

Authorized Signature

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Contractor agrees to maintain a staff of properly trained and experienced personnel to ensure satisfactory performance under this Agreement. Contractor agrees that all persons connected with the Contractor directly in charge of the Service are duly registered and/or licensed under all applicable federal, state and local, laws, regulations, and ordinances. Contractor will assign to the Project a designated representative who will be responsible for the administration and coordination of the Service.

Safety and Cleanliness

Contractor shall maintain clean and safe conditions at all times and shall not do or permit anything to be done on the University's premises beyond the scope of the Services unless approved in writing in advance by University. Contractor shall leave University's premises as clean or cleaner than they found it.

Licensing and Registrations

Contractor shall obtain any and all approvals, licenses, filings, registrations and permits required by federal, state or local law for the performance of the Services or Contractor's other duties and obligations under the terms of this Agreement and abide by all applicable federal, state and local laws.

Access to University Premises

(1) Limited Access. Contractor, its employees, permitted subcontractors and agents, shall have the right to use and access only those University facilities that may be reasonably necessary to perform its obligations hereunder and shall have no right to use or access any other facilities of University. University shall provide to Contractor reasonable access to the University's facilities, equipment and employees, and shall otherwise cooperate with Contractor, only as reasonably necessary for Contractor to perform its obligations under this Agreement.

(2) Identification and Refusal of Entry. Contractor acknowledges that University has the rights to (a) require identification from any person on the University's premises, (b) refuse entry to persons having no legitimate business on the University's premises, and (c) eject any undesirable person refusing to leave peaceably on request. Contractor shall cooperate with all authorized University representatives in the exercise of University's rights

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described in the preceding sentence.

(3) Compliance with Laws and Policy. Contractor shall perform the Services and conduct all its operations on University's premises in conformity with all applicable federal and state laws, rules and regulations, local ordinances, and University Rules, including but not limited to, prohibitions related to tobacco use, alcohol, and other drugs. For purposes of this Agreement, "University Rules" means (i) the Rules and Regulations of the Board of Regents of The University of Texas System, (ii) the Administrative Rules of The University of Texas System (both of which may be found at www.utsystem.edu/bor/homepage.htm; and (iii) the institutional rules and regulations and policies of the University (which may be found at www.utsa.edu).

(4) Conduct on Premises. Contractor represents, warrants and agrees that it shall conduct all of its activities on University's premises in a manner that (1) does not disturb or interfere with University's academic programs or administrative activities or any program or activity that is conducted by or is authorized by University or the U.T. System; (2) does not interfere with entry to or exit from a building, structure, or facility; (3) does not interfere with the flow of pedestrians or vehicular traffic on sidewalks or streets or at places of ingress and egress to and from University property, buildings, or facilities; (4) does not harass, or intimidate any person or persons; and (5) provides appropriate protection for the privacy of University's students, faculty, and staff, including without limitation, Contractor's adherence to all applicable laws and industry standards for preserving the confidentiality of personal financial information and personal identification numbers.

(5) Contractor Vehicles. All Contractor's vehicles and equipment associated with the Services shall be kept clean and maintained in good working condition. All such vehicles and equipment shall be in compliance with all federal, state, and local laws, regulations, and requirements.

(6) Response to Emergencies. Contractor shall immediately respond to and take corrective action for, all emergencies associated with the services, including but not limited to chemical spills, or fuel/motor oil spill. Contractor shall ensure that there is no danger to the public health, safety or welfare due the services provided herein.

Authorized Signature

Purchase Order

UTSA
The University of Texas at San Antonio
One UTSA Circle
San Antonio TX 78249
United States

Dispatch Via Print		
Purchase Order	**Date**	**Revision**
UTSA1-0000000030	2014-05-08	
Payment Terms	**Freight Terms**	**Ship Via**
Net 30 Day	FOB Destination	Best Avail
Buyer	**Phone**	**Currency**
Mariano Alaniz	210/458-5077	USD

Vendor: 0000028791
CARL ZEISS
MICROSCOPY LLC
1 ZEISS DR
THORNWOOD NY
105941939
United States

Ship To: CR10104
UTSA
CENTRAL RECEIVING
WAREHOUSE
One UTSA Circle
San Antonio TX 78249
United States

Attention: Not Specified

Bill To: UTSA
Disbursements and
Travel Services
One UTSA Circle
San Antonio TX 78249
United States

Tax Exempt? Y **Tax Exempt ID:** TEXAS STATE AGENCY **Replenishment Option:** Standard

Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date

****

EQUAL OPPORTUNITY CLAUSES:

As an Equal Opportunity and Affirmative Action employer, UTSA is committed to meeting all federal compliance standards. In accordance with the recent revision of federal regulations with respect to protected veterans and individuals with disabilities, this communication serves as notice with respect to our current contract, subcontract, or purchase order. The parties hereby incorporate the requirements of 41 CFR - 60-1.4(a), 60-300.5(a) and 60-741.5(a), if applicable.

This contractor and subcontractor shall abide by the requirements of 41 CFR - 60-1.4(a), 60-300.5(a) and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, or national origin. Moreover, these regulations require that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, national origin, protected veteran status or disability.

****

Item Total 2200.00

Authorized Signature

Purchase Order

UTSA
The University of Texas at San Antonio
One UTSA Circle
San Antonio TX 78249
United States

Dispatch Via Print		
Purchase Order	**Date**	**Revision**
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Payment Terms	**Freight Terms**	**Ship Via**
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Tax Exempt? Y **Tax Exempt ID:** TEXAS STATE AGENCY **Replenishment Option:** Standard

Line-Sch	Item/Description	Mfg ID	Quantity	UOM	PO Price	Extended Amt	Due Date

****

SIGN UP FOR DIRECT DEPOSIT PAYMENT BY COMPLETING A VENDOR DIRECT DEPOSIT AUTOMATIC AUTHORIZATION AGREEMENT BY COMPLETING THE DIRECT DEPOSIT "VENDOR" FORM FROM THE FOLLOWING WEBSITE.
HTTP://WWW.UTSA.EDU/FINANCIALAFFAIRS/FORMS

SEND COMPLETED FORMS TO DISBURSEMENTS.TRAVEL@USTA.EDU OR FAX TO 210-458-4829.

****

FOR FURTHER INFORMATION CONTACT "REQUESTOR" DR. ARTURO PONCE 210-458-8267, ARTURO.PONCE@UTSA.EDU OR "DEPARTMENT" CONTACT, Susana Patino AT 210-458-6955, susana.patino@utsa.edu

FOR PURCHASING QUESTIONS CONTACT MARIANO ALANIZ AT 210-458-5077 OR MARIANO.ALANIZ@UTSA.EDU

THIS PURCHASE ORDER IS BEING ISSUED IN ACCORDANCE WITH THE TERMS AND CONDITIONS SET FORTH IN DEPARTMENT OF TEXAS PROCUREMENT AND SUPPORT SERVICES CONTRACT TPASS RFP. # 490-M2, UNDER VENDOR QUOTE# 545-34500167-3

PROPOSER: GERMAN NEAL

DATED: 31 MARCH 2014

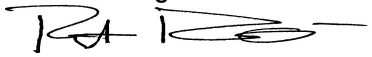
VENDOR: CARL ZEISS MICROSCOPY, LLC

VENDOR QUOTE# 545-34500167-3

Total PO Amount 734412.00

The University's Standard Purchase Order Terms and Conditions located at http://utsa.edu/purchasing/TC_PO.cfm are incorporated into and are part of this Purchase Order for all purposes

Authorized Signature



Appendix E
Installation Test
(21 pages)

Acceptance Test Record Crossbeam 340

Addendum to Acceptance Certificate from

Contents

About this Acceptance Test Record

This document records in detail the correct delivery, installation and function of the certified Crossbeam 340 workstation.

Please notice that the specified parameters of the Crossbeam 340 refer to the basic instrument at optimum environmental conditions. The adaptation of options such as airlocks, EDX systems, and EBSD may possibly influence certain parameters.

All magnification indications refer to the setting Polaroid.

* Entries marked with this sign are described in detail under Explanation Acceptance Test procedure.

† Tests/items described in a paragraph marked with a cross are not to be performed/checked upon factory acceptance.

Identification of the System

Type: Crossbeam 340	**Serial No.:** 47.28

Upgrades

FIB column	☒		**Charge Compensation**	
			Charge Compensator (CC)	☐
GAS Injection System			GIS with charge compensation (CC)	☐
Single needle GIS	☐			☐
Five-channel GIS	☒			☐
	☐			☐
LASER				☐
Rapid Laser Ablation Upgrade	☐			☐

Supplies	
Water chiller	☒
Compressor	☐

Detectors (optional)	
Inlens detector	☒
InlensDuo detector	☐
SE detector	☒
SESI detector	☐
VPSE detector	☒
EsB© detector	☐
4QBS detector	☒
STEM detector	☒
SESI detector	☐
CL detector	☐
	☐
	☐
	☐
	☐

Accessories	
Airlock	☒
Beam blanker	☐
Cooling stage	☐
Cryo transfer	☐
EBSD	☐
EDX	☐
Flood Gun	☐
Micromanipulator	☐
Plasma Cleaner	☐
Quiet Mode	☐
WDX	☐
	☐
	☐
	☐

Pre-installation +

			O.K.
B1	Environment	Instrument room corresponds to specification	☒
B2	Shock/tilt watches	Shock watches and tilt watches OK	☒
B3	Basic instrument	Basic instrument (including all components necessary for operation of the Crossbeam workstation) intact and complete	☒
B4	Options	All options delivered according to customer's order	☒
B5	Documentation	Folder "Important documents" delivered (contains user documentation)	☒

Installation and function tests

Overall system +

			O.K.
C1	Cabling	All cables and connections installed correctly, power supply and protective conductors checked	☒
C2	Transport locks	All transport locks removed	☒
C3	PCBs	All PCBs tightly installed	☒
C4	Water cooling system	Function of water cooling system checked, tested for leaks	☒
C5	Compressed air/nitrogen	Compressed air/nitrogen installed and checked	☒
C6	Ventilation	Function checked	☒
C7	Damping system	Damping system adjusted correctly	☒

A. Computer

CPU: Intel Core i5 Random Access Memory (Mbyte): 8.00 GB

Operating system: Windows 7 SmartSEM® version: V.05.07 SP3

Specification according to SmartSEM® EM server:

HW / FW Stage controller: 3.6.5 FW Stage axis: 5

HW / FW Vac: 2.3.0 HW / FW EO dyn: 01.000

HW / FW SVSEM: 10.4.10.79 HW / FW EO static: 01.02

HW / FW EHT: 7.0.2.1 FW FIB:

FW IPPSU: 1.0

			O.K.
D1	Drives	Images in TIFF format can be saved on disk and hard disk and reloaded without loss of information	☒
D2	Network (if installed)	Error-free transmission of TIFF files via network checked	☐
D3	Monitor	Brightness and contrast adjusted by means of 'Grey Wedge' (Annotation): Good black and white levels and optimum grey level dispersion obtained	☒
D4*	Output media (if delivered)	Function of output media (video printer, printer, slide recorder) checked	☐ N/A
D5*	Operating system/ software/firmware	Operating system is booting error-free, SmartSEM® software has been installed completely (back-up), all software licences delivered according to customer's order	☒

Vacuum system

				O.K.
E1	System vacuum	System vacuum (specimen chamber vacuum) checked after at least 12 hours uninterrupted pumping of the specimen chamber (without specimen) Desired value: less than 5 x 10^{-6} mbar	Value (mbar) $1,4 \times 10^{-6}$	☐
E2	Gun vacuum	Gun vacuum (UHV chamber vacuum) checked after baking out the UHV chamber for at least 12 hours; Gun on, EHT switched off Desired value: less than 5 x 10^{-9} mbar	Value (mbar) $1,2 \times 10^{-9}$	☒
E3	VP mode	Chamber vacuum can be varied continuously between 10 and 133 Pa between 10 and 60 Pa for InlensDuo detector Switching between high vacuum and VP mode is correct		☒
E4	Airlock (optional)	Airlock functions and correct drive of specimen stage to exchange position checked		☒
E5	Pumping times	Pumping times until SEM 'Vac Status=Ready' determined: maximum 5 min via airlock: The pumping time refers to a single process of either loading or unloading 200 mm airlock Desired value: maximum 45 s 80 mm airlock Desired value: maximum 30 s	Determined time (min) 25 sec	☒
E6	Quiet Mode (optional)	Does pre-vacuum pump switch on and off between pre-vacuum gauge threshold values (VAC test program)		☐ N/A
E7	Plasma cleaner (optional)	Execute recipe "Quick sample clean"		☐ N/A

Specimen stage

			O.K.
F1	Initialisation	Stage moves to limit switches and is positioned in the centre of X and Y axes after initialisation	☒
F2	Control panel/ joystick	All motorised axes can be controlled via control panel/joystick Magnification compensation and force/deflection compensation possible	☒
F3	Touch alarm	Touch alarm works; stage stops when touch alarm is initiated or "BREAK" is pressed	☒
F4	Storage of coordinates	Coordinates of all motorised axes can be stored together with magnification and working distance Stored coordinates can be re-approached	☒
F5	Centring functions (optional license)	Options Centre Point, Continuous Centre Point and Centre Feature checked	☒
F6*	Stage drift	Stage drift checked: Stage drift after 6 minutes less than 40 nm in X- and Y-direction	☒
F7*	Repeatability	Repeatability of the specimen stage (zero tilt) checked (X- and Y-drive) better than 3 µm	☒

Detectors and video system

			O.K.	
G1	VPSE detector	Function checked in VP mode, signal intensity changes with VP pressure. Signal intensity changes with collector voltage changes. No arcing below 290V collector.	☑	
G2	In-lens/InlensDuo detector	Function of In-lens detector checked	☑	
G3	SE/SESI detector	Function of SE detector checked; modification of collector voltage results in a change of the signal intensity	☐	N/A
G4	EsB detector	Function of EsB detector checked	☐	N/A
G5	4QBS detector (if delivered)	Demonstration of the function of the 4QBS detector by means of an appropriate specimen. The switching between topography contrast (TOPO) and material contrast (COMPO) has to be checked . Function of 4QBS detector checked, material contrast checked on appropriate specimen Switching between topography (TOPO) contrast and material contrast (COMPO) checked.	☑	
G6	STEM detector (if delivered)	Function of STEM detector checked, DF & BF imaging possible	☐	
G7	CCD	Function of CCD camera checked	☑	
G8	2nd CCD (if delivered)	Function of CCD camera checked	☑	
G9	CL detector (if delivered)	Function of CL detector checked	☐	N/A
G10	Mixing	Two different detector signals can be mixed between 0 and 100%	☑	
G11	Noise reduction	Improvement of signal/noise ratio by using different scan rates and frame/line average checked	☑	
G12	Internal specimen current monitor	Function of internal specimen current monitor checked	☑	

SEM Filament

Tip type (manufacturer): FEI ☐ DENKA ☒

Tip serial number: 218142

Filament heating current Fil I (data sheet): 2.35 A (SmartSEM®): 2.33 A

Extractor voltage at 0.2 mA/sr (data sheet): 3610 V (SmartSEM®): 3720 V

Total Current at 0.2 mA/sr (data sheet): 127 µA

Extractor current I_{0kV} (SmartSEM®) at 0 kV : 134.00 µA

Extractor current I_{10kV} (SmartSEM®) at 10 kV: 99.5 µA 112 nA 2/2/15

O.K.

H1* Specimen current	Specimen current measured by means of Faraday cup at acceleration voltage 10 kV, 30µm aperture and WD 2 mm; deactivate condenser Desired values: Without condenser 220-230 pA	Value (pA) 235 pA	☒

Electron optics

				O.K.
J1*	Beam shift	Manual beam shift by appr. +/-100 µm		☒
J2	Scan rotation	SEM image can be rotated electronically (0 to 360°)		☒
J3*	Dynamic Focus/Tilt angle correction	Function of dynamic focus and tilt angle correction on tilted specimen checked		☒
J4*	Stigmator	Correction of stigmator at acceleration voltage 10 kV, 30µm aperture, no high current, WD 2 mm, specimen: gold-on-carbon Desired value: maximum 30 %	Stigmator value X (in %) 1,2 % Stigmator value Y (in %) 1,5 %	☒
J5*	Measuring functions	Measuring functions possible in live and stored image; Distance measuring at acceleration voltage 10 kV, 30µm aperture, no high current, WD 5 mm, 1 µm grid Desired value: better than ± 3 %		☑
J6	Beam Blanked	Blanking electron beam checked		☑
J7	Store Resolution	Switching to different store resolutions checked		☑
J8	Scan modes	Different scan modes (Split Screen, Dual Mag, Quad Mode, Reduced Raster) checked for all store resolutions		☑
J9*	Resolution Low kV	Resolution image taken at minimum 200 kX with In-lens detector at 1 kV		☑
J10*	Resolution High kV	Resolution image taken at minimum 400 kX with In-lens detector at 15 kV		☑
J11	Charge Compensator (if installed)	Load a non-conducting specimen (e.g. piece of paper) Insert the Charge Compensator Select In-lens detector, 500 X, 1 kV, WD= 5 mm CC pressure: 0% and 100% System vacuum changes to 6-7 e-3 mBar @ 100%, gun vacuum not getting poorer than 5e-9mBar Function checked		☐ N/A
J12	Column adjustment	Column adjustment checked		☑
J13	Maximum current reached	20 or 100 nA related to version		☑

FIB Column (optional)

FIB Filament

Type: Gallium emitter

FIB Extr. Target: ..... -7.90 kV ..... kV

Emission Current: ..... 2 ..... µA

FIB Vacuum

			O.K.
L1	FIB Gun Vacuum (IGP1)	Vacuum level after 12 hours pumping Desired value: less than 5 x 10^{-7} mbar	☒
L2	FIB Column Vacuum (IGP2)	Vacuum level after 12 hours pumping Desired value: less than 5 x 10^{-7} mbar	☒

Ion Optics

			O.K.
L3	Beam shift (FIB)	Manual beam shift checked and calibrated (±15µm)	☒
L4	Scan rotation (FIB)	FIB image can be rotated electronically (0° to 360°)	☒
L5	Beam blanked (FIB)	Measure FIB Beam Current in Faraday Cup on specimen stage, Blank Ion beam and measure the same current in Column faraday cup. Now the Specimen current in the SCM must be zero.	☒
L6*	Resolution 30 kV	Resolution image taken	☒
L7	Gun valve	Function of gun valve checked, no Vacuum leak to Gun when Specimen chamber is vented	☒
L8	FIB probe current calibration	All FIB probe currents calibrated and aligned (Beam current ± 20%; Apertures wobbled; on Probe currents > 1nA Spot profile centered & Defocus aligned; Beamshift correction aligned)	☒
L9	MAG Calibration	FIB Mag calibration checked. (Probe Current 30KV:10pA; Mag 8000x; Chessy @ 1µm grid) Desired value: better than ± 3 %	☒

Milling

			O.K.
L10*	TEM Lamella	Mill a TEM Lamella (req. *SmartFIB Auto prep* licence) of a silicon sample using SmartFIB	☑

* For detailed information see chapter Explanations Acceptance Test procedure.

Gas Injection System (optional)

Single GIS 1 N/A

			O.K.
M1.1	Positions of injector needle	Working position adjusted	☑
M2.1	Reservoir heating	Temperature stored and checked (Gas Injection System panel)	☑
M3.1	Capillary heating	Temperatures checked (Gas Injection System panel)	☑
M4.1	Outgassing	Outgassing function works	☑
M5.1	Precursors used	Channel 1:..... T:.....°C Target temperature (T) checked (Gas Injection System panel)	☑
M6.1	Reservoir usage	Reservoir usage function is setup to monitor the consumption	☑

N/A

Single GIS 2

			O.K.
M1.2	Positions of injector needle	Working position adjusted	☐
M2.2	Reservoir heating	Temperature stored and checked (Gas Injection System panel)	☐
M3.2	Capillary heating	Temperatures checked (Gas Injection System panel)	☐
M4.2	Outgassing	Outgassing function works	☐
M5.2	Precursors used	Channel 1:..... T:.....°C Target temperature (T) checked (Gas Injection System panel)	☐
M6.2	Reservoir usage	Reservoir usage function is setup to monitor the consumption	☐

N/A

Five-Channel GIS

			O.K.
M7	Positions of injector needles	Positions of all injector needles stored and checked	☑
M8	Initialisation	Micro stage can be initialised with all axes	☑
M9	Reservoir heating	All temperatures stored and checked (Gas Injection System panel)	☑
M10	Capillary heating	All temperatures checked (Gas Injection System panel)	☑
M11	Outgassing	Outgassing function works with all precursors	☑
M12	Precursors used	Channel 1: Tungsten T: 88 °C Channel 2: Platinum T: 70 °C Channel 3: XeF2 T: 8 °C Channel 4: Insulator T: 45 °C Channel 5: Carbon T: 85 °C All target temperatures (T) checked (Gas Injection System panel)	☑
M13	Reservoir usage	Reservoir usage function is setup to monitor the consumption	☑

Deposition

			O.K.
M14*	Deposition (54° stage tilt)	Deposition of all installed materials performed and images are taken at 54° stage tilt.	
		Tungsten	☑
		Platinum	☑
		Carbon	☑
		Insulator	☑
		Other material:.....	☐ N/A
	Deposition (≤ 10° stage tilt)	Deposition of one installed material performed and image is taken at ≤ 10° stage tilt.	☑

Gas Assisted Etching

			O.K.
M15*	Enhanced etch	Enhanced etching performed and images taken:	
		XeF_2	☑
		Iodine	☐ N/A
		Water (only if Carbon precursor installed)	☐ N/A

* For detailed information see chapter Explanations Acceptance Test procedure.

N/A

Laser System (optional)

				O.K.
N1	Laser protection	All measures that reduce the class of the Laser to Laser class 1 are tested and working.		☐
N2	Laser integration	Laser system is completely integrated and system check and adjustment was performed.		☐
N3	Laser airlock	Airlock is continuously pumping, when PUMP Is activated and the stage position for un-/loading a sample holder is set up.		☐
N4	Laser power	(Before performing this test, the Laser has to be active for at least 60 minutes) Laser power reaches desired value after max. five minutes testing time (using 33 kHz pulse freq.) Desired value: Average laser power 2.0 W		☐
N5	Focus height	Focus height is set to the correct value using DEFOCUS.VLF file on silicon. Desired value: Focus: 17 mm above the stub		☐
N6	Spot shape	Single laser spot shape burned into silicon is circular (with 95% power, 400 mm/s step speed, 10 kHz pulse freq.).		☐
N7	LaserMill	Start macro is integrated in SmartSEM, communication to TruTops Mark and LaserMill server works via COM port and Ethernet.		☐
N8	Scanfield center	The scanfield center is set up using OFFSET_XY.VLF on a paper sheet and offset table is filled in TruTops Mark software.	Offset value X (mm) Offset value Y (mm)	☐

N9	Scanfield angle	The scanfield angle is set up using OFFSET_ROTATION.VLF and filled in as offset angle in TruTops Mark software (nominal value ~270°).	Offset angle R (°)	☐
N10	Scanfield calibration	The scanfield was calibrated and the desired accuracy value is reached during a standard laser procedure. The center of the milled feature has to be within a radius of the maximum displacement around a prior selected target. Desired value: Max. displacement: 20 µm	Displacement (µm)	☐

N/A

User training +

The user training should give the customer basic information on the Crossbeam workstation and enable him/her to handle the Crossbeam and to perform fundamental applications. Parts of the user training can be done when checking the performance parameters of the Crossbeam.

The following users have attended the training:

1) Sandra ~~Fretel~~ Vergara 2) Eduardo Ortega

3) Jochen ~~Vergara~~ Arelle-Jimenez 4) .....

			O.K.
P1	Safety rules	User has been informed on all safety rules to be applied when operating the Crossbeam workstation	☒
P2	StartUp/STANDBY	Basic operation of Crossbeam workstation explained: o start of the instrument from StandBy mode o structure of software menu: tool bar, status bar, important windows o switching on/off filament, liquid metal ion source and acceleration voltages o short explanation of standard tool bar o adaptation of specimen and specimen holders, mounting/dismounting spacer o venting of specimen chamber and specimen change o setting and adjustment of important functions such as selection of apertures, Mag/Focus, Aperture Align, Stigmation etc o operation with different detectors o finding the eucentric point o finding the coincident point o applications: SEM imaging (FIB Mode SEM), FIB imaging (FIB Mode FIB), CrossBeam® Mode (Mill + SEM) o working with SmartFIB (basic functions) o FIB Daily adjust o different scan modes and storage resolutions o working with the optional gas injection system (if delivered): deposition, gas assisted etching (enhanced etching and selective etching) o saving and loading images o short explanations of the measuring functions and of Display/Input LUT o output of images on the different output media o use of hard panel/joystick, important stage controls o closing the software and switching off the instrument	☒
P3	Administrator	It has been demonstrated how to install new user directories and how to activate special settings for these directories System responsible has changed the password to "SYSTEM" after this introduction.	☒
P4	Bake-out ion getter pump	Bake-out of ion getter pump explained, instructions given on relevant safety rules when baking out.	☒
P5	Options	Operation with additional options such as airlock, REMCON etc explained and demonstrated.	☒
P6	Teleservice	Operation of Teleservice explained and demonstrated	☒ N/A

Explanations Acceptance Test procedure

\+ Tests/items described in a paragraph marked with a cross are not to be performed/checked upon factory acceptance.

D4 Output media
Check of the function of all output media such as sending a saved image from the SmartSEM® software directly to the printer or, in case of a video printer, copying a saved image directly from the screen. For slide recorders, use the control software RasterPlus 95. The conversion of the magnification value is only possible for output media whose printer driver can be read by the SmartSEM® software.

D5 Operating system/software/firmware
Check of the error-free start of Windows® and of the complete installation of the SmartSEM® software. A backup copy should be made of all important system files such as em server.accdb, L500.ini, and the licence file. It is recommended to make backup copies of all important Windows® files. The installed software and firmware versions will be documented.

F6 Stage drift
For testing the stage drift select magnification 200 kX. Select a detail of the specimen image and remember it. Wait four minutes. Using the annotation menu, create a circle of 80 nm diameter. The selected specimen detail must be in the centre of the circle (do not shift the circle). Wait six minutes: The stage drift is OK, if the selected specimen detail is still within the circle.

F7 Repeatability
Check of the repeatability of the specimen stage by means of the macro KompassKlein. At least 85 % of the 16 marks (i.e. 14 marks) should be positioned within a circle with the radius of the specified repeating accuracy. The respective macros are contained in the directory 'SUPPORT'.
Be careful that specimen and/or detectors cannot be touched by the moving stage.

H1 Specimen current
A Faraday cup will be used to measure the specimen current. After adjustment of the electron beam (Aperture Align, Wobbler) at 10 kV, WD 2 mm the magnification will be set so that the complete electron beam is focused in the orifice of the Faraday cup.

J1 Beam shift
Test of the manual beam shift to be done at 20 kV and a working distance of 8.5 mm. The total shift in X and Y direction should be at least 200 (+/- 100) µm at these operation conditions.

J3 Dynamic focus/Tilt angle correction
Check of the dynamic focus and of the tilt angle correction should be done with a 1µm grid. To do so, the grid will be tilted to appr. 45° by means of the specimen stage. The test will be carried out at 10 kV, crossover with 200 pA, WD appr. 10 mm and magnification appr. 5000 X. First, optimum focus will be adjusted in the centre of the screen by means of a slider small reduced scan. Then the reduced scan will be displaced to the upper or lower end of the screen. After activation of the dynamic focus, the image will be optimized in the

reduced scan at a scan rate of 10 or more by means of the slider (FCF Setting). Then the complete image will be stored in the image store with these settings. If the dynamic focus is to be combined with the tilt angle correction, the field Tilt Corrn. will be activated and the tilt angle of the stage will be entered via the slide control Tilt Angle. The tilt direction must always be parallel to the scan direction.

J4 Stigmator

First, adjustment of 200 pA in crossover mode is done with a gold-on-carbon specimen at a working distance of 2 mm, a magnification of 50 kX and an acceleration voltage of 10 kV (Wobbler). To obtain an optimum image, the stigmator values for X and Y should not be corrected by more than 30 %, add user and database value. The set values will be documented.

J5 Measuring functions

Control of the measuring function is carried out with a 1 µm grid. Optimum adjustment of the image is done at a magnification of 15 kX, an acceleration voltage of 10 kV, a working distance of 5 mm and crossover mode with 200 pA. Measuring is done by means of a vertical measuring cursor over 5 grid distances, while the 4QBSE detector is fully retracted. The measured value should not differ by more than 3 % from the original distance (5 µm).

J9/ J10 SEM: Resolution Low kV/Resolution High kV

The resolution is determined by using a gold-on-carbon specimen & ZEISS Software '*PATE*' that is based on the so-called *Edge resolution criteria*. The following resolution values are specified for the Crossbeam 340 workstation:

Probe current	EHT	Resolution
20 nA	1 kV	1.9 nm#
20 nA	15 kV	1.0 nm#
100 nA	1 kV	2.1 nm#
100 nA	15 kV	1.2 nm#

at optimum working distance

Lowest current in crossover free mode.

Depending on the environmental conditions, the quality of these images should be comparable to those taken in the final test and stored on the hard disk

L6 FIB: Resolution 30 kV

The resolution images will be taken on a platinum aperture serving as specimen. Images are taken with the SE detector. The Zeiss 'PATE' software is used to measure the resolution.

Select the 1 pA probe current, if necessary adjust the Condenser voltage to improve the signal, set the magnification to at least 150kx. The specified resolution is 3 nm.

L10 TEM Lamella

Mill a TEM Lamella of a silicon sample using the SmartFIB program. The dimensions of the lamella are: Width: 10 µm, Depth: 5 µm, Thickness 1µm. Use 3 milling steps (3nA, 300pA, 50pA) incl. Platinum deposition, Drift correction and Cut-out

M14 Tungsten

Rectangle of 20 µm x 1 µm, deposition time t ≤ 5 min
Desired value of thickness: 300 nm
Name of image file: tungsten.tif

Silicon dioxide
Rectangle of 20 µm x 1 µm, deposition time t ≤ 5 min
Desired value of thickness: 500 nm
Name of image file: insulator.tif

Platinum
Rectangle of 20 µm x 1 µm, deposition time t ≤ 5 min
Desired value of thickness: 500 nm
Name of image file: platinum.tif

Carbon
Rectangle of 20 µm x 1 µm, deposition time t ≤ 5 min
Desired value of thickness: 500 nm
Name of image file: carbon.tif

M15 Parameters for enhanced etch

XeF2
Use a silicon specimen.
Rectangle of 10 µm x 10 µm, etching time: 300 s, FIB probe current: 20 pA.
Etch a square with XeF2.
Etch a square without XeF2.
The square etched with XeF2 should be significantly deeper.
Name of image file: XeF2.tif

Iodine
Use an aluminum specimen.
Rectangle of 10 µm x 10 µm, etching time: 300 s, FIB probe current: 200/220 pA.
Etch the square with iodine.
Etch the square without iodine.
The square etched with iodine should be significantly deeper.
Name of image file: Iodine.tif

Room for remarks

Exhaust line not vented yet to be finished very soon

Signatures

Place ..... Date 02/04/2015

Signature service engineer: Signature/s customer:

.....

Effective from: January 2015